New Hanover County Vulnerability Assessment

New Hanover County, North Carolina vulnerability assessment case study.

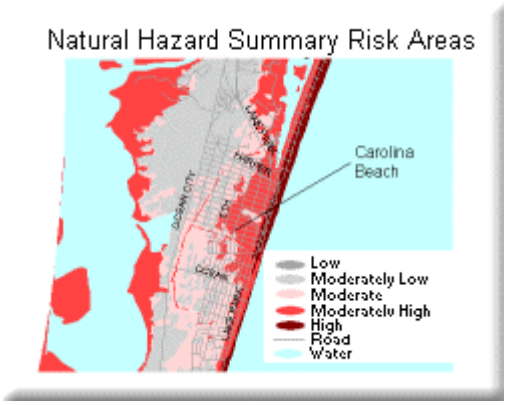
Introduction

This case study follows the general methodology established in the Vulnerability Assessment Tutorial. It illustrates the various steps in the tutorial utilizing examples completed for New Hanover County, North Carolina. By following this case study, you can examine how geographic information system (GIS) can be used to conduct vulnerability assessment analyses and aid in visualizing analysis results. While this case study follows the methodology outlined in the tutorial, it is only one example of how to complete the steps identified. While the use of GIS is not required to conduct a vulnerability assessment, this case study demonstrates the value of GIS as an analytical tool in this process.

This case study is organized according to the steps defined in the Vulnerability Assessment Tutorial. The tutorial instructions for each step are included in bold italic text and the remaining narrative for each step describes how those instructions were applied in the New Hanover County example. Examples of New Hanover County maps and tables are also included to illustrate the output capabilities of GIS. For GIS users who wish to explore the data used in this case study, ArcView® and ArcExplorer® project files are included. If you are interested in developing a similar project for your community, information on metadata and potential data sources is also included on the Internet Data Resources page.

Determine which hazards you will evaluate in your vulnerability assessment. This can either be a comprehensive list of all hazards posing some threat to the community or a more limited list of specific hazards for which you are planning.

Hazard Identification



Step 1a: Identify hazards.

While it is advisable to conduct your vulnerability assessment for the multitude of hazard threats facing your community, there may be reasons for only addressing certain hazards. Limited hazard information or a limited focus on hazard mitigation strategies can sometimes dictate the hazards selected for this process. You may also choose to address some hazards primarily from their secondary impact potential. For example, hazardous spills may be evaluated as a potential impact associated with vulnerability to hurricanes, flooding, or earthquakes.

For background information on New Hanover County Hazards, please visit the Hazard History Section.

In New Hanover County, the following natural hazards were addressed in the vulnerability assessment:

Hurricane Storm Surge	**Coastal Erosion**
Wind	**Earthquake**
Flood	**Wildfire**
Tornado	

Hazardous spills and toxic release hazards were considered as secondary hazard impacts in Step 6-Environmental Analysis.

Step 1b: Establish relative priorities for your hazards.

Use factors such as probability, magnitude, or potential impact area to help you establish priorities for dealing with hazards and identifying hazard mitigation options.

The ideal method for assigning priorities to the various hazard threats would be a scientific, quantifiable probability assessment. Unfortunately, probability data are not consistent among the different hazard types, nor are they always available or useable at the local level. As an alternative, communities can develop a relative priority matrix to use as a general guide for addressing the different hazards. Designing such a matrix requires you to determine which factors are most critical to your community and assign weights accordingly. Factors can include hazard frequency, the amount of land typically impacted, or the magnitude of damages associated with the hazards. The purpose for this step is to initiate thought and discussion about the hazards and their potential impacts. It is a subjective exercise where the scores alone do not have absolute statistical significance. The comparison of hazard scores, however, will give you relative rankings that can guide your vulnerability assessment process as well as your hazard mitigation priorities.

The scoring system developed for New Hanover County:

(Frequency* + Area Impact*) x Potential Damage Magnitude*
= Total Score

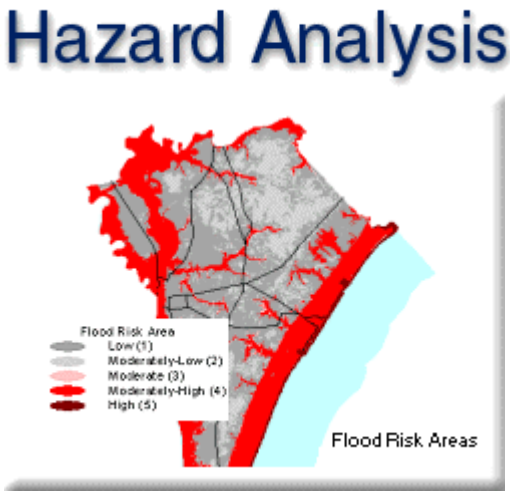
*The frequency, area impact, and potential damage magnitude values are defined by a scale of numbers ranging from 1 to 5, where 1=low and 5=high.

Sample New Hanover County Relative Priority Matrix

Hazard	Frequency +	Area Impact x	Magnitude =	Total
Storm Surge	2	4	5	**30**
Wind	3	5	4	**32**
Flood	4	4	4	**32**
Tornado	2	1	5	**15**
Coastal Erosion	3	2	3	**15**
Earthquake	1	4	5	**25**
Wildfire	3	3	3	**18**

Figure 3.1

Utilize the best available information to identify high potential impact areas for each of your hazards. In some cases (i.e., tornadoes), you may not be able to target high-risk locations but in others (i.e., flooding or storm surge) you may have access to useful risk area data. Remember that the purpose of this step is to help you target priority areas for the remaining analyses.



Step 2a: Map risk consideration areas for hazards.

The difference between risk and vulnerability is an important distinction in this step. Risk consideration areas identify geographically (on maps) those areas most likely to be affected by a given hazard. The people and resources located within the risk consideration areas are considered to be at risk from hazards and may or may not be vulnerable to hazard impacts. The vulnerability of the people and resources within the risk consideration areas is a function of their individual susceptibility to the hazard impacts. For example, in one neighborhood of 50 homes there are 10 structures located within the floodplain (risk consideration area). These 10 structures would be considered potentially at risk to flooding and would be the targets for vulnerability assessment. Seven of the structures are elevated above the 100-year flood elevation and the remaining three structures are not elevated. The three non-elevated structures would be considered vulnerable to flooding. In this example, the risk consideration area (floodplain) helps narrow the target of the detailed vulnerability assessment from 50 structures to 10 structures.

To effectively narrow the focus of your vulnerability assessment, you must first identify the risk consideration areas for your hazards. The more risk data that are available, the more opportunity there is to focus vulnerability assessment activities in your highest-risk areas. It is possible, however, to develop some prioritization capacity using limited publicly available data and to improve upon it over time using more accurate local data sources. For each hazard being addressed, you should research the available data concerning the location of high-risk areas. Internet Data Resources includes information on some potential data sources.

If you have hazards with limited areas of risk (i.e., coastal erosion is limited to coastal interfaces) you will want to limit your vulnerability assessment to only those areas. Similarly, if you have hazards with varying degrees of risk throughout your community (i.e., flooding can occur almost anywhere but floodplains are particularly high risk) you will want to target vulnerability assessment in your highest-risk areas. It is appropriate to refer to these designations as risk consideration areas since they are locations you consider at risk to hazard impacts based on your best available information sources. Obviously, the better the risk data available, the more accurate your assessment will be.

In New Hanover County, a risk consideration area was established for each hazard. Some of the risk consideration areas are descriptive and relatively effective in targeting vulnerability assessment activities, while others are default designations, lacking useful risk data. Below is a description of the risk consideration areas:

Hurricane Storm Surge

Risk consideration areas were mapped using output from the National Oceanic and Atmospheric Administration (NOAA) Hurricane Storm Surge Inundation Model. These areas represent locations that might expect to be impacted by storm surge events.

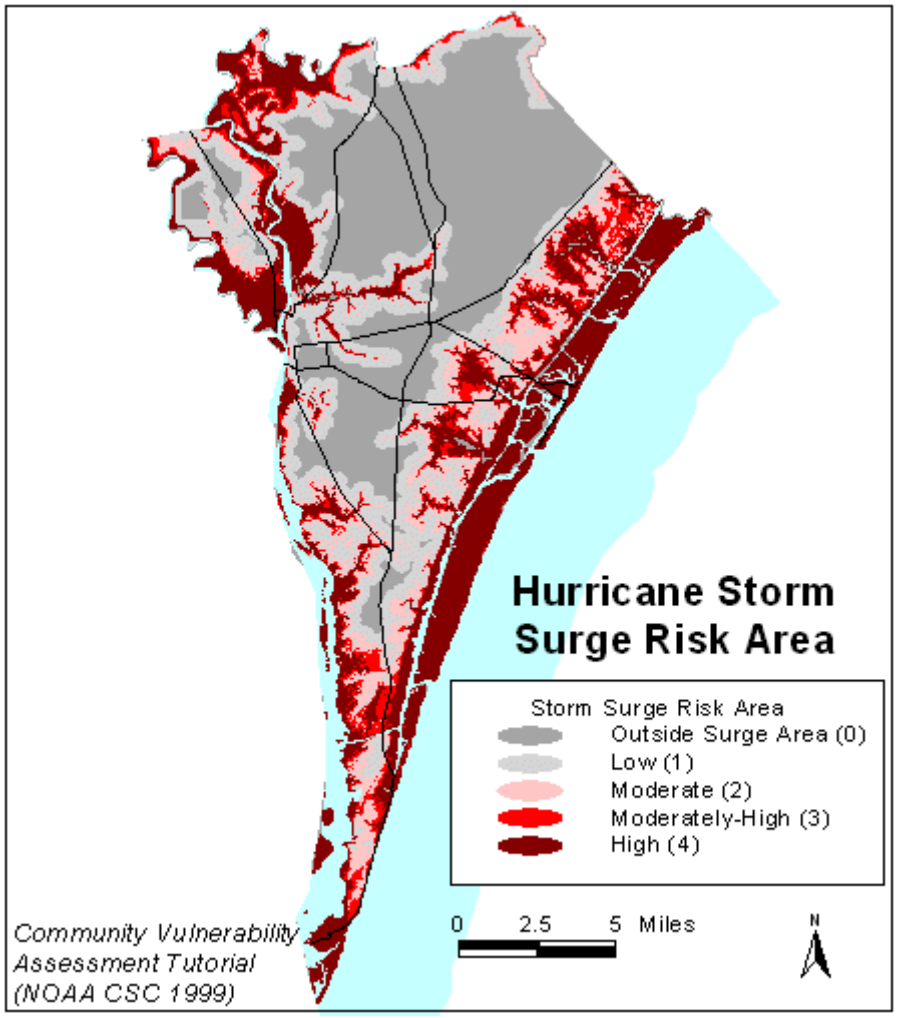


Figure 3.2

Flood

Risk consideration areas were mapped using output from Federal Emergency Management Agency's (FEMA) Flood Insurance Rate Maps (FIRM).

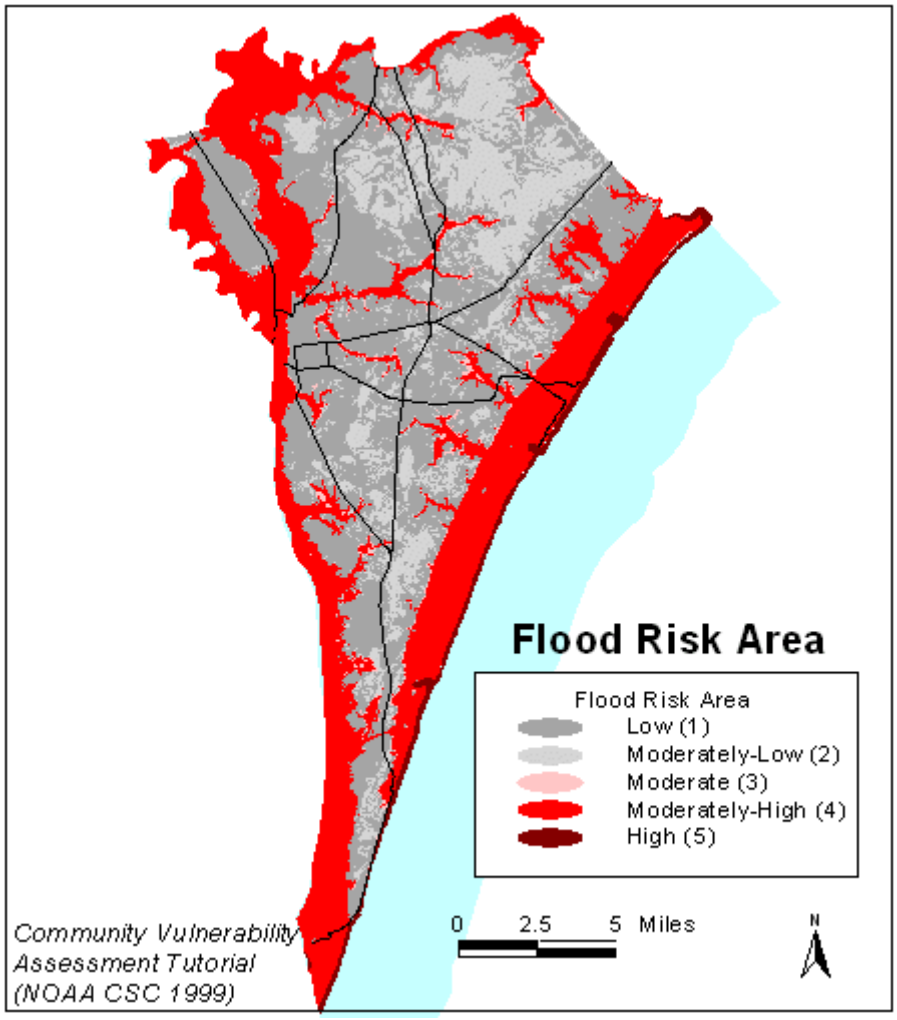


Figure 3.3

Coastal Erosion

Risk consideration areas were confined to the barrier islands and mapped using distance from the first line of stable vegetation as a baseline.

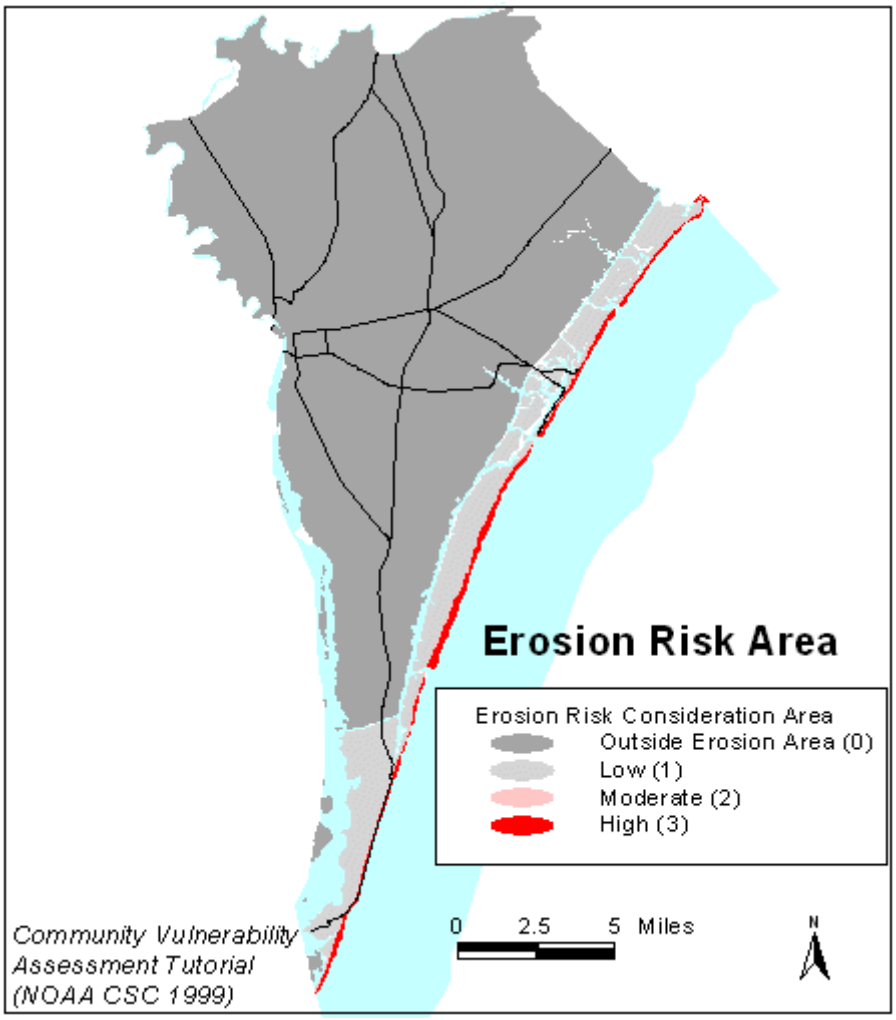


Figure 3.4

Wind

Risk consideration areas were mapped using the barrier islands as a boundary for high-wind potential.

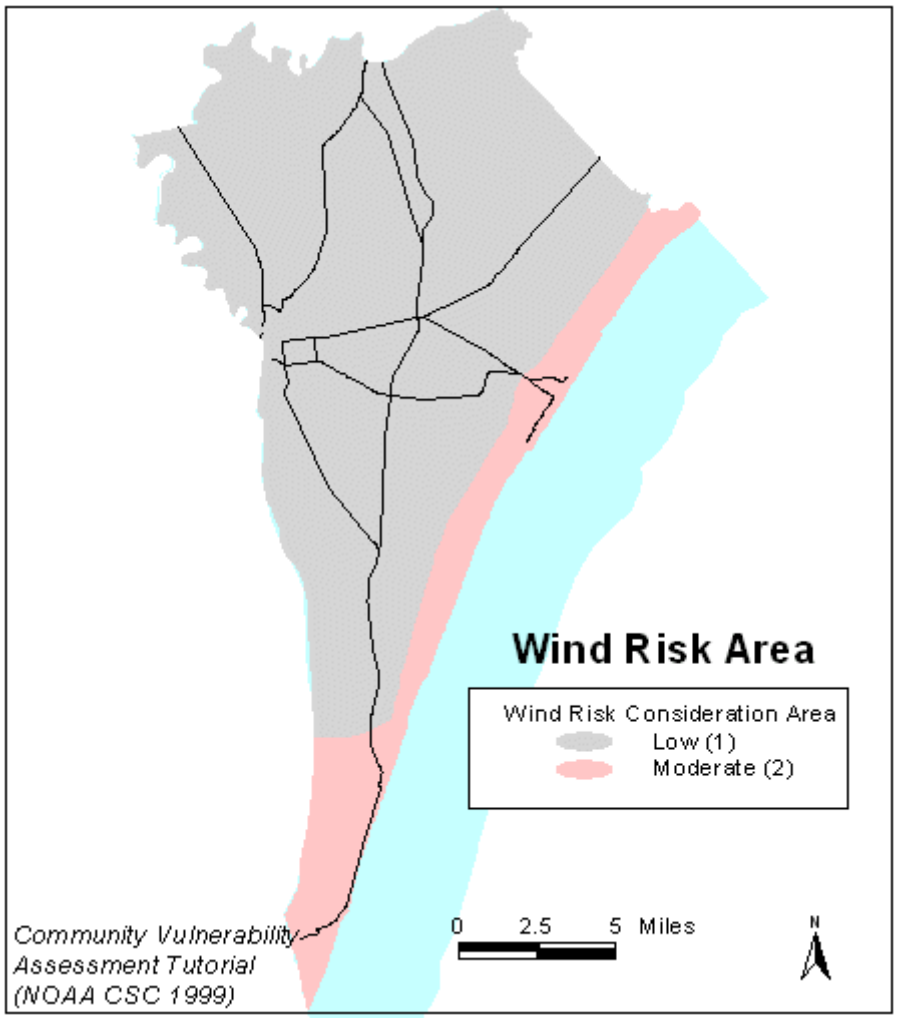


Figure 3.5

Wildfire

Risk consideration areas were mapped by identifying the amount of forested land available as potential fuel for the hazard.

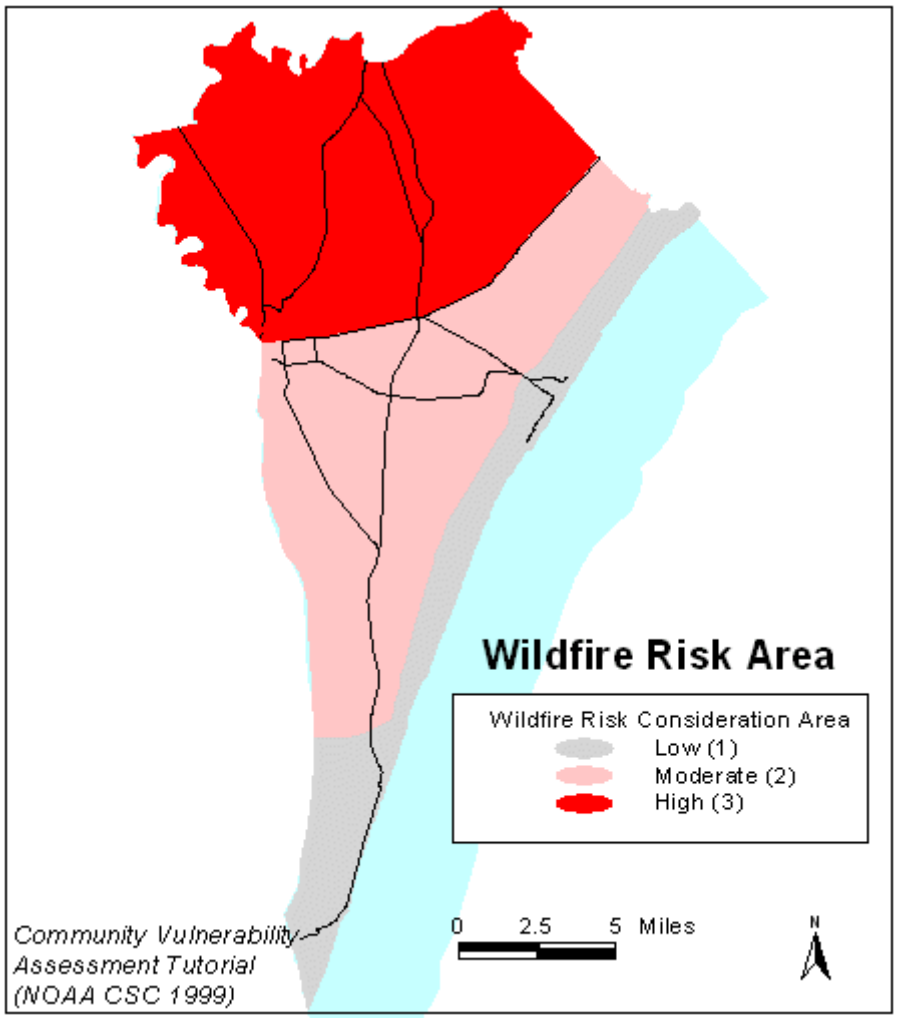


Figure 3.6

Earthquake

The same general level of risk exists throughout the county.

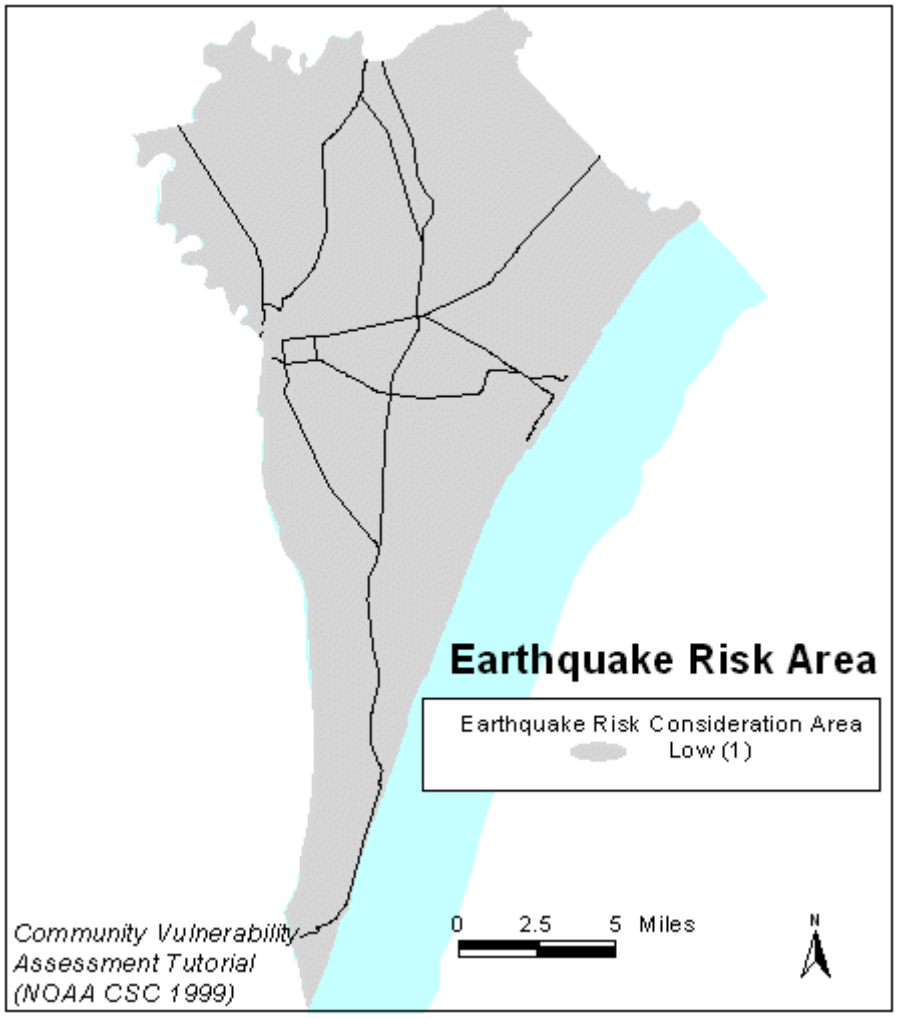


Figure 3.7

Tornado

The same general level of risk exists throughout the county.

To help you further prioritize, in many cases it will be possible to establish some relative ranking within the risk areas. For example, flood risk areas for 10- or 50- year floods should be ranked higher than for 100-or 500- year floods. Utilize the best available data to establish your priority rankings, wherever possible.

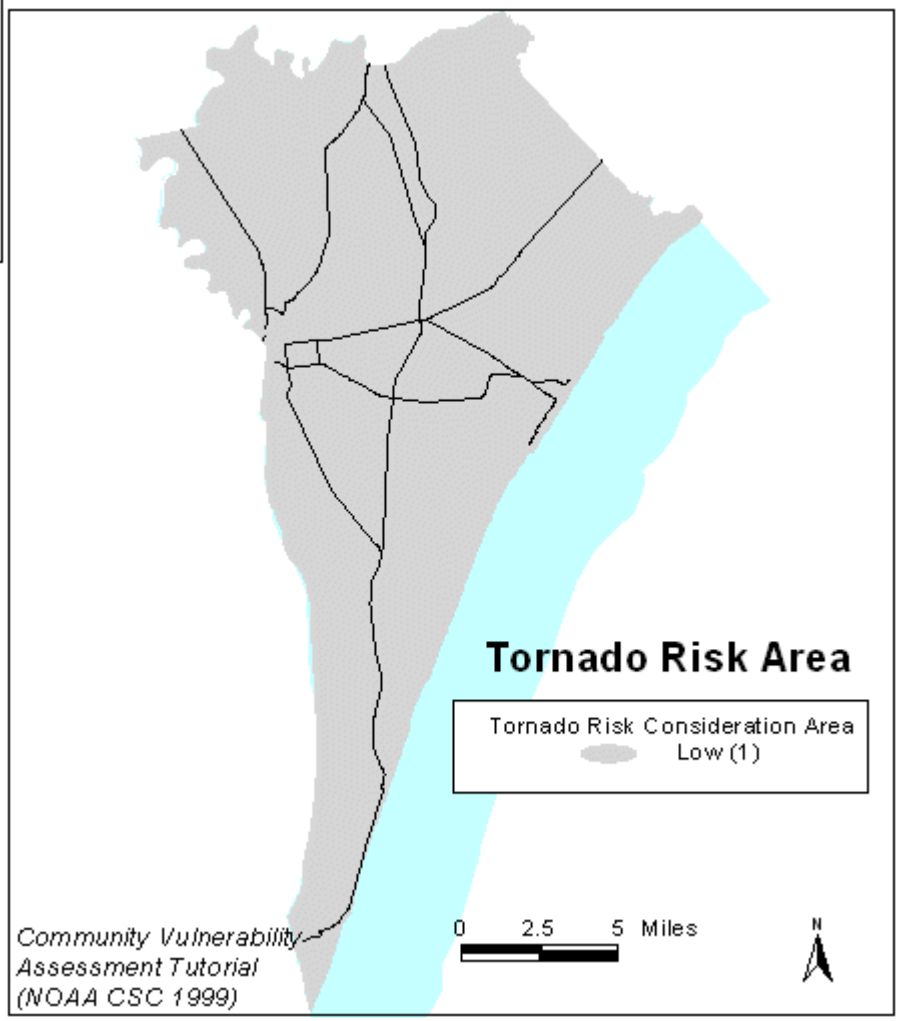


Figure 3.8

Step 2b: Assign scores within risk consideration areas, where possible.

Within your risk consideration areas there could be additional boundaries representing varying degrees of risk. These varying degrees of risk should be represented in your risk consideration areas both graphically (additional boundaries on the maps) and through some type of relative scoring system (higher scores for higher risk areas). For example, hurricane storm surge maps are generally created for five different category storms. Category 1 storms are generally associated with the least severe winds and storm surge while Category 5 storms are considered most severe. Generally, those areas subject to storm surge in the lower category storms are also projected for inundation in all of the higher categories. When developing a relative priority scoring system for storm surge inundation, Category 1 storm surge areas would therefore have the highest risk of being flooded since they are at risk of inundation in all storm events.

The table below shows the relative priority scoring system developed for the risk consideration areas in New Hanover County. The general concept is that locations with no

consideration for risk will have a score of 0 and each incremental increase in risk adds 1 point.

Natural Hazard Risk Consideration Area Scoring			
Hurricane Storm Surge Risk Areas	**Risk Score**	**Highest**	**Lowest**
Storm Surge Category 1 & 2	4	4	0
Storm Surge Category 3	3		
Storm Surge Category 4 & 5	2		
Storm Surge Buffer (0.25 mile from entire surge coverage)	1		
Remainder of County	0		
Flood Risk Areas	**Risk Score**	**Highest**	**Lowest**
Flood V & VE Zones (Velocity Zone)	5	5	1
Flood A & AE Zones (100-Year Floodplain)	4		
Flood X500 Zone (500- Year Floodplain)	3		
Flood Prone Soils (Outside Flood Zones V, VE, A, AE, & X500)	2		
Remainder of County	1		
Erosion Consideration Risk Areas	**Risk Score**	**Highest**	**Lowest**
High (immediately adjacent to ocean)	3	3	0
Medium (near ocean)	2		
Low (remainder of barrier island)	1		
Remainder of County	0		
Wind Consideration Risk Areas	**Risk Score**	**Highest**	**Lowest**
Barrier Islands (seaward of the Intercoastal Waterway)	2	2	1
Remainder of County	1		
Wildfire Consideration Risk Areas	**Risk Score**	**Highest**	**Lowest**
High (highest density of pine)	3	3	1
Medium (pines interspersed with development)	2		
Low (barrier islands)	1		
Earthquake Consideration Risk Area	**Risk Score**	**Highest**	**Lowest**
Entire County	1	1	1
Tornado Consideration Risk Area	**Risk Score**	**Highest**	**Lowest**
Entire County	1	1	1
Natural Hazard Risk Potential Scores		**19**	**5**

Figure 3.9

In this example, only two of the hazards have any locations with a risk consideration score of 0 (hurricane storm surge and coastal erosion). In both cases the maximum extent of the hazard risk does not realistically include the entire county but is limited to proximity to coastal waters.

The minimum risk score for each of the remaining hazards is 1 since there is some potential for each of these hazards to occur anywhere throughout the county. Due to a lack of detailed geographic risk information on tornadoes and earthquakes, the maximum risk score of 1 is evenly distributed throughout the county.

Hurricane Storm Surge

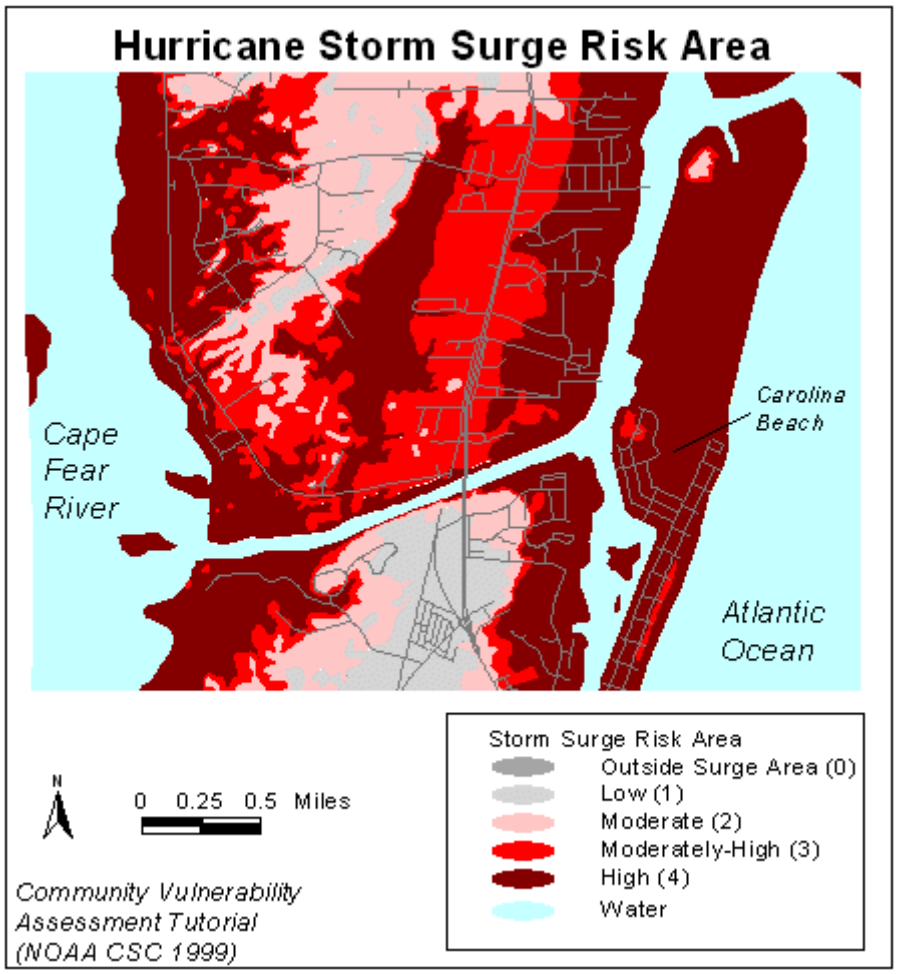


Figure 3.10

Surge zones are generally delineated according to hurricane categories on the Saffir-Simpson scale (Categories 1 through 5). Locations that are subject to inundation from the lowest category storm event are considered at highest risk, as they will likely be inundated during stronger events as well. Therefore, Category 1 and 2 hurricane storm surge inundation areas are given a high-risk consideration score of 4. Category 3 inundation areas are given a score of 3, and Category 4 and 5 inundation areas are assigned a score of 2. Because of the difficulty in making clear boundaries, a 0.25-mile buffer was established around the surge

inundation zones and given a risk consideration score of 1. All other areas of the county receive a 0, as they are not likely to be impacted by hurricane storm surge.

Flood

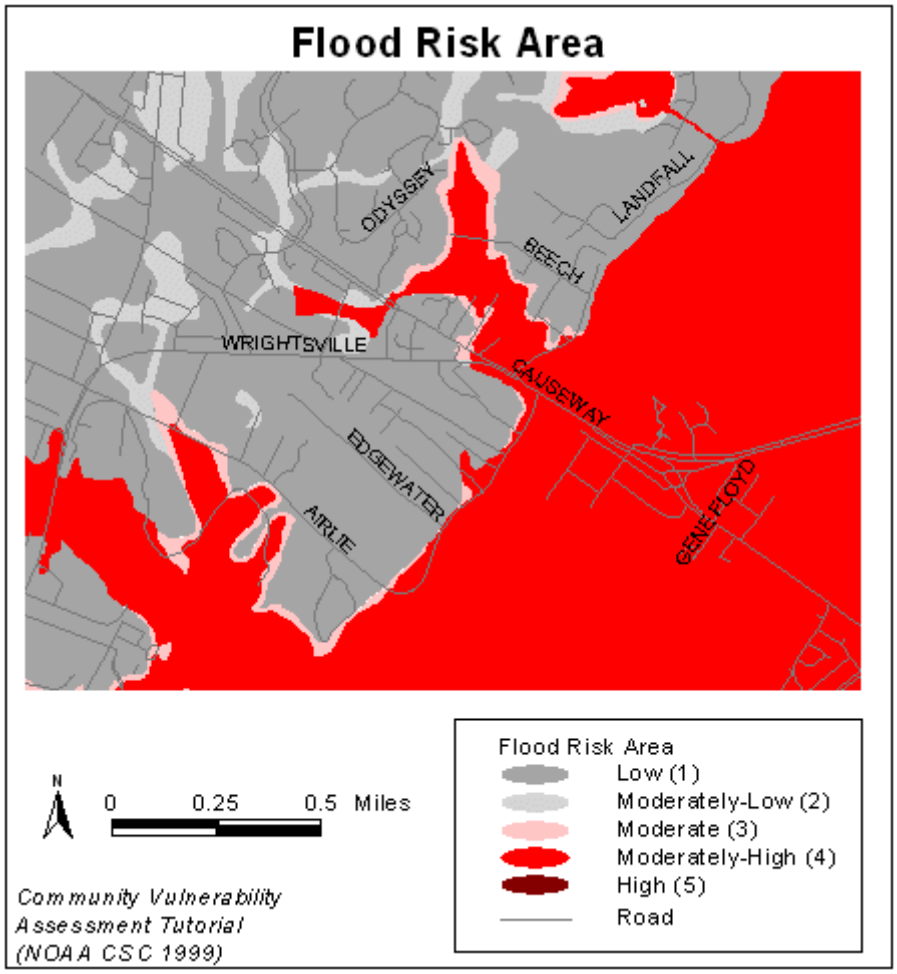


Figure 3.11

The risk consideration area scores for flood hazards were determined by using

Federal Emergency Management Agency's (FEMA) Flood Insurance Rate Maps (FIRM). The FIRMs are developed from the output of hydrologic models, identifying areas with high potential for flooding. The risk consideration area score of 5 is given to the Velocity Zone (V-Zone) where coastal flooding and wave action risks are highest. The second highest score of 4 is applied to the 100-year floodplain and a score of 3 is given to the 500-year floodplain. Areas located outside the floodplain but appearing on flood-prone soils are rated with a score of 2. All other areas of the county receive a score of 1.

Coastal Erosion

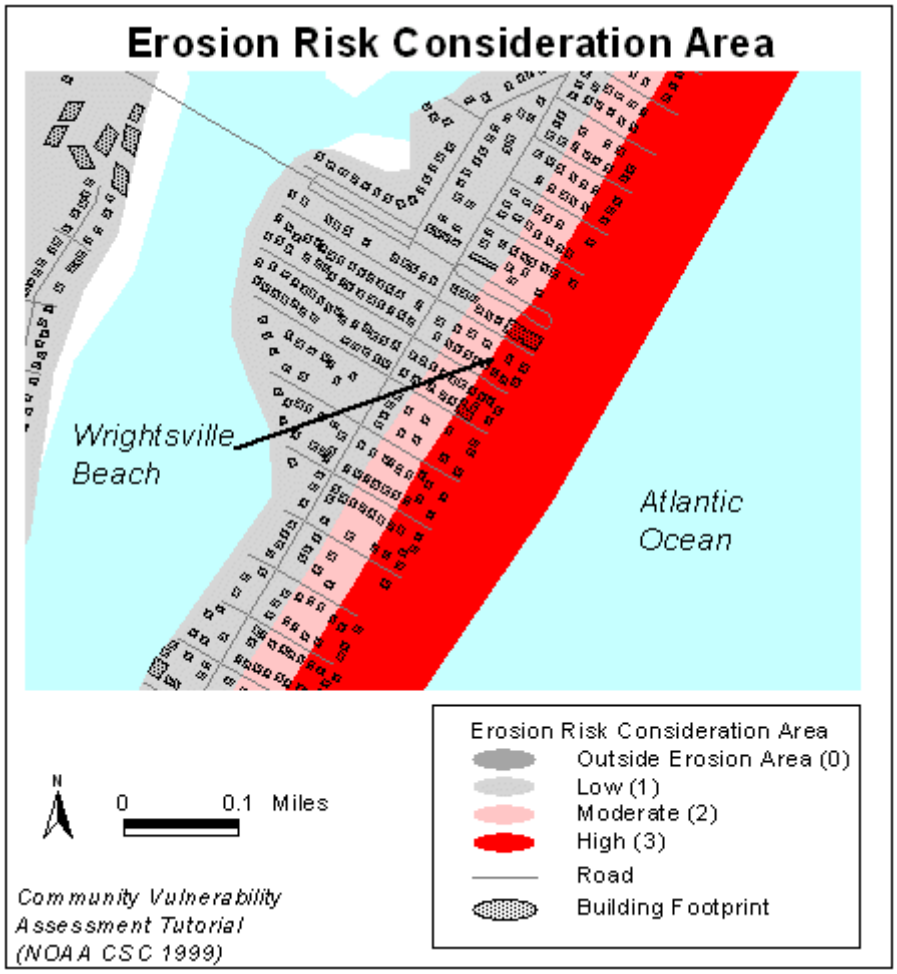


Figure 3.12

Risk consideration scores for erosion were determined based on distance from the first line of stable vegetation along the shore. This vegetation line was delineated using New Hanover County's aerial photography as a base. Those areas inland of the vegetation line to 210 feet are assigned a score of 3. Areas between 210 and 420 feet are assigned a score of 2 and the remaining areas on the barrier islands receive a rating of 1. The mainland portion of the county is assigned a 0, as there is an insignificant level of erosion risk in those areas.

Wind

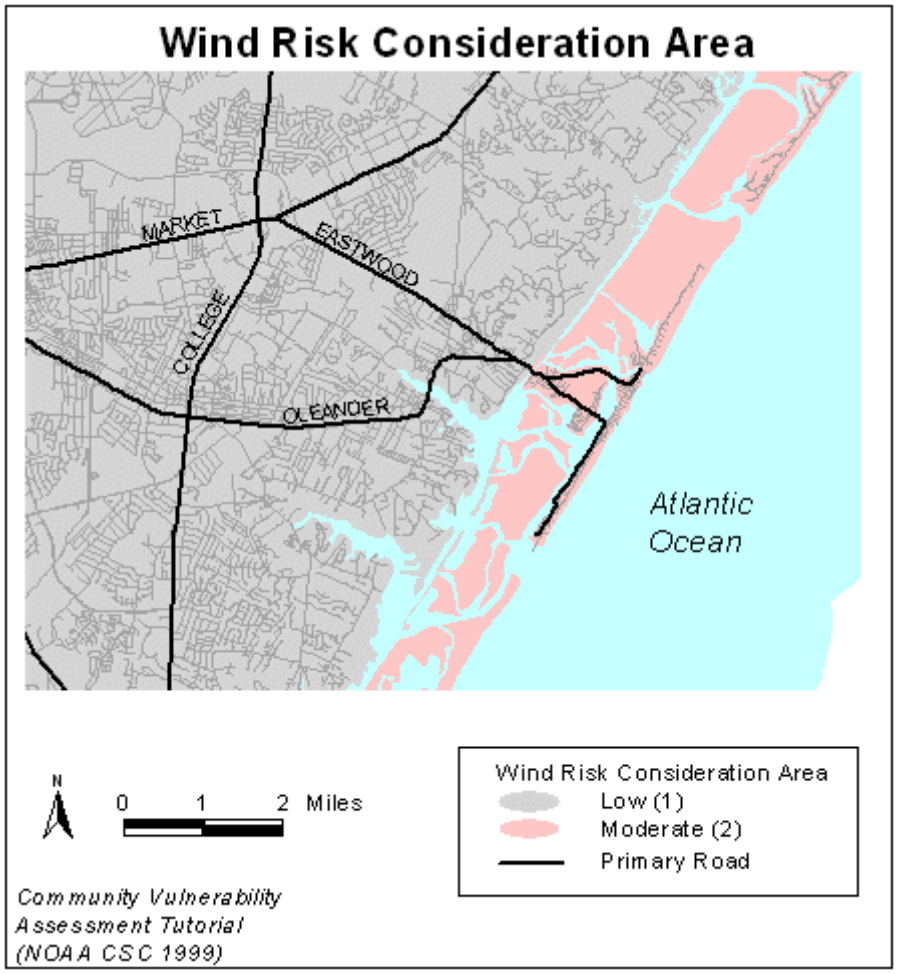


Figure 3.13

The risk consideration area scores for wind hazards are determined by proximity to the coast. The barrier islands receive a high score of 2 while the remainder of the county receives a score of 1.

Wildfire

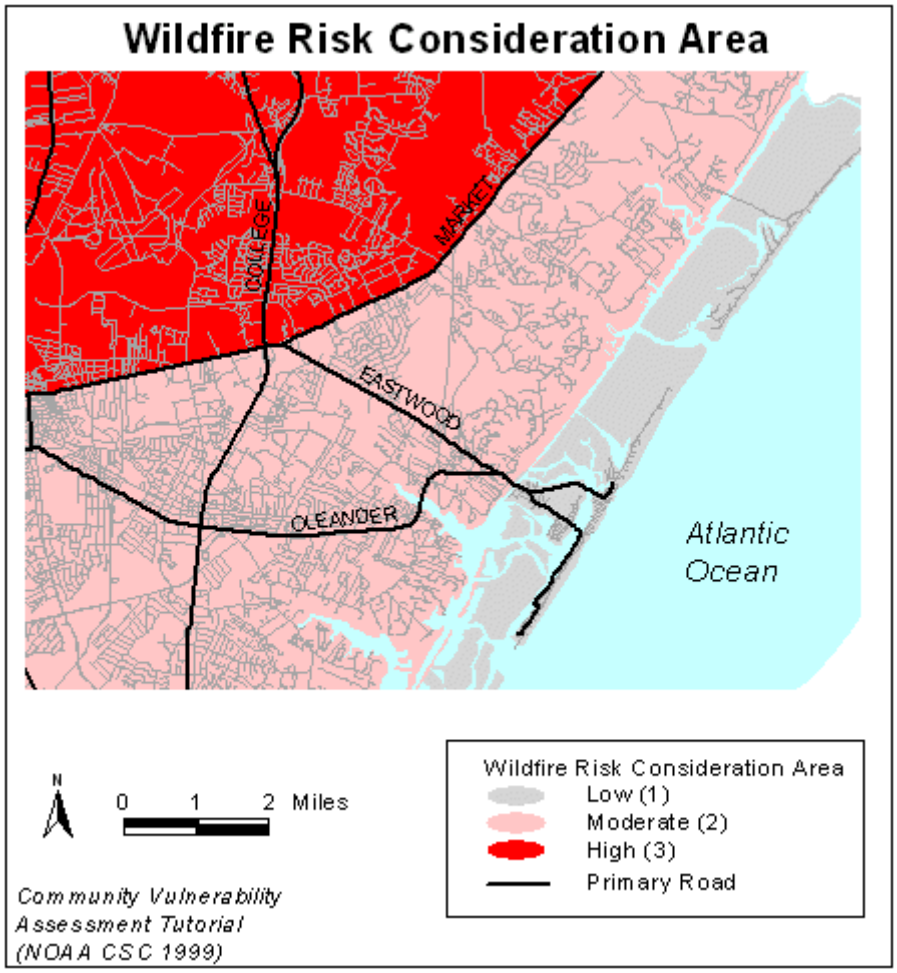


Figure 3.14

Risk consideration area scores for wildfires are determined by the concentration of the primary fuel source, pine trees. The area in the northern part of the county contains dense pine cover and receives a score of 3. The central portion of the county, where pine is interspersed with development, receives a score of 2. The barrier islands, which are least densely forested with pine, are assigned a score of 1.

Earthquake

The risk consideration area score is 1 throughout the county.

Tornado

The risk consideration area score is 1 throughout the county.

Summary Scores

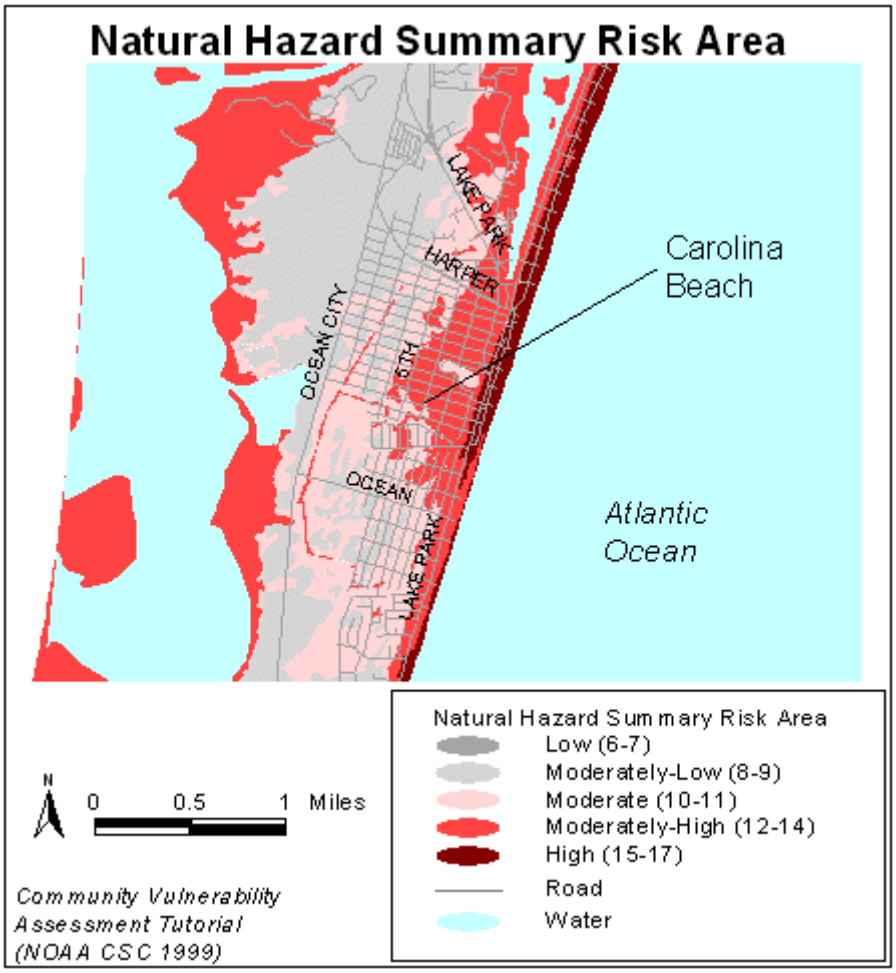
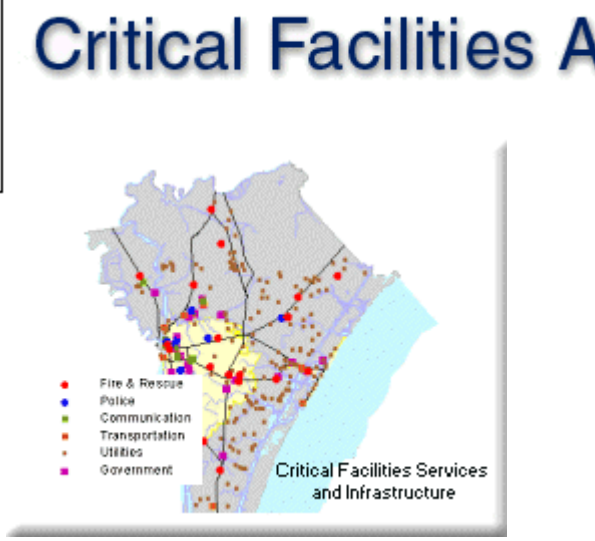


Figure 3.15

Using a GIS, the seven risk consideration areas were combined and the scores were added together to create summary scores for every location in the county. These summary scores were used to develop a summary risk area map. The summary scores also provide the foundation for ranking high-risk areas in the remainder of the analyses.

This analysis focuses on determining the vulnerability of key individual facilities or resources within the community. Since it is not usually feasible to conduct such an analysis for every structure in a community, you should focus on identifying the categories of structures that you would consider "critical facilities" for purposes of conducting individual facility assessments.

Next, establish a critical facilities database by collecting some general information. The type and amount of information collected depends on your intended use of the database, but at a minimum should contain information identifying facility types and locations.



Step 3a: Identify critical facilities categories.

The completion of a critical facilities analysis is probably one of the most important elements in a community-wide vulnerability assessment. The first step in this analysis is to determine which facilities you consider to be critical facilities. Start by determining your critical facilities categories and prepare to organize your database accordingly.

The critical facility categories for New Hanover County include:

- Shelters
- Schools
- Hospitals and Nursing Homes
- Fire and Rescue
- Police
- Utilities
- Communications
- Transportation
- Government

Step 3b: Complete a critical facilities inventory.

Most local emergency management offices collect and maintain information on certain categories of critical facilities. This information may provide a starting point for your critical facilities inventory. It is important to collect accurate information about these facilities and

their locations as these data will be essential for completing the individual facility assessments in the next step of this analysis.

The data collected for New Hanover County's database includes:

- Facility type
- Facility name
- Street address
- City
- State
- Zip
- Owner/operator
- Contact name
- Contact title
- Contact telephone
- 24-hour telephone
- Township
- Fire district

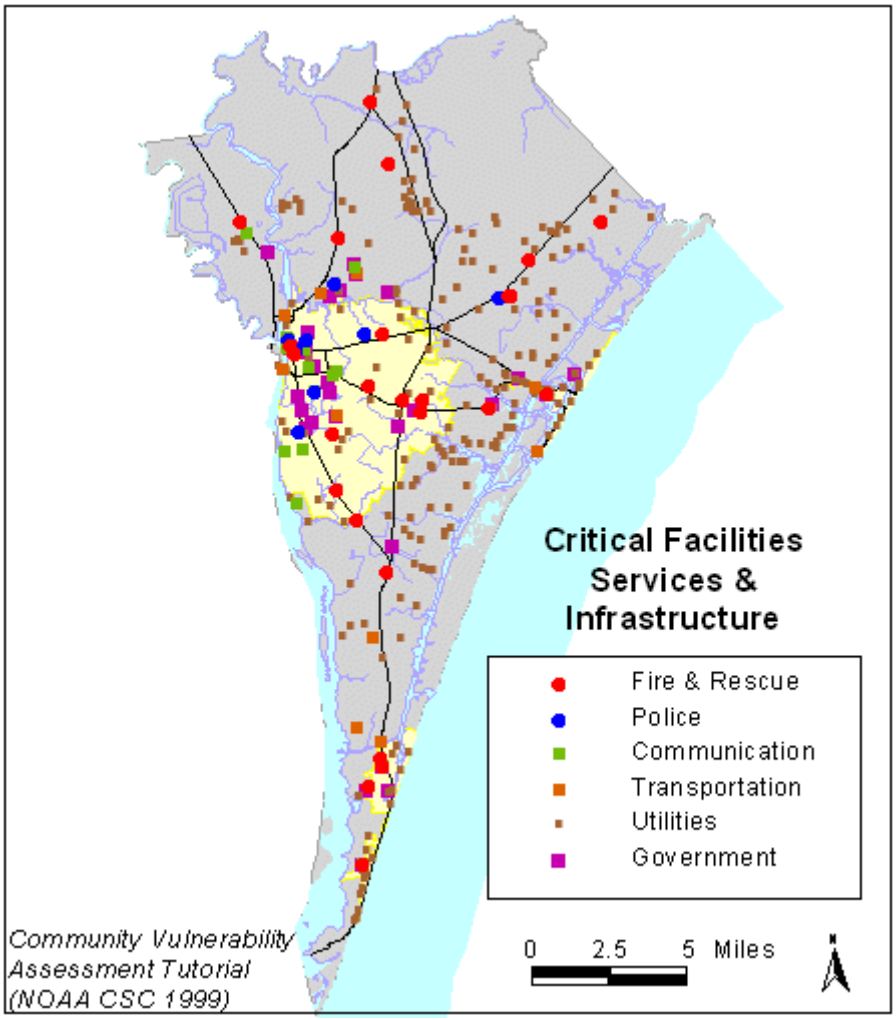


Figure 3.16

The facility locations shown above represent critical community resources.

To help prioritize potential hazard mitigation for critical facilities, you should identify risk area scores for each of the critical facilities. Overlay the critical facilities with the hazard risk consideration areas.

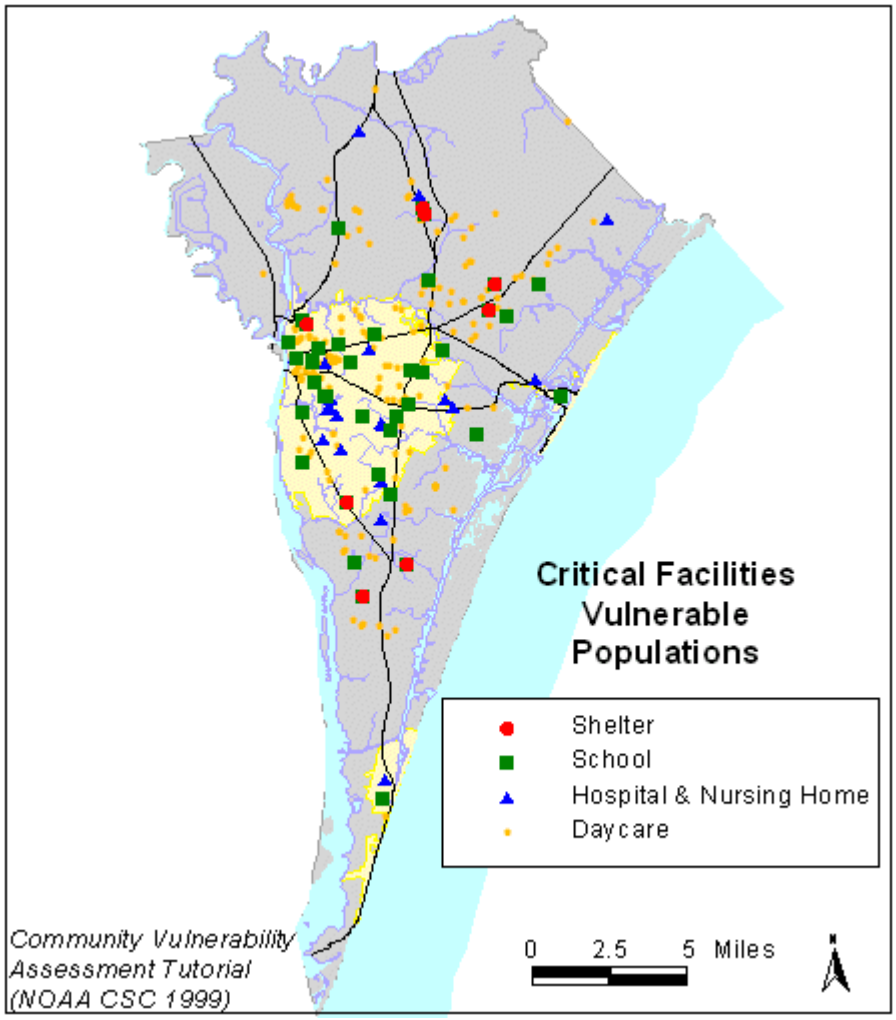


Figure 3.17

The facility locations shown above represent special needs populations that are also included in New Hanover County's critical facilities database. These are locations where special attention is given to disaster preparedness and hazard mitigation due to the high concentration of vulnerable populations.

Step 3c: Identify intersections of critical facilities with high-risk areas.

This step helps you identify the hazard risks associated with your critical facilities. In the case study, summary hazard risk scores were applied to all of New Hanover County's critical facilities. The structures located in high-risk areas were targeted by New Hanover County as priority facilities for conducting detailed structural and operational vulnerability analysis.

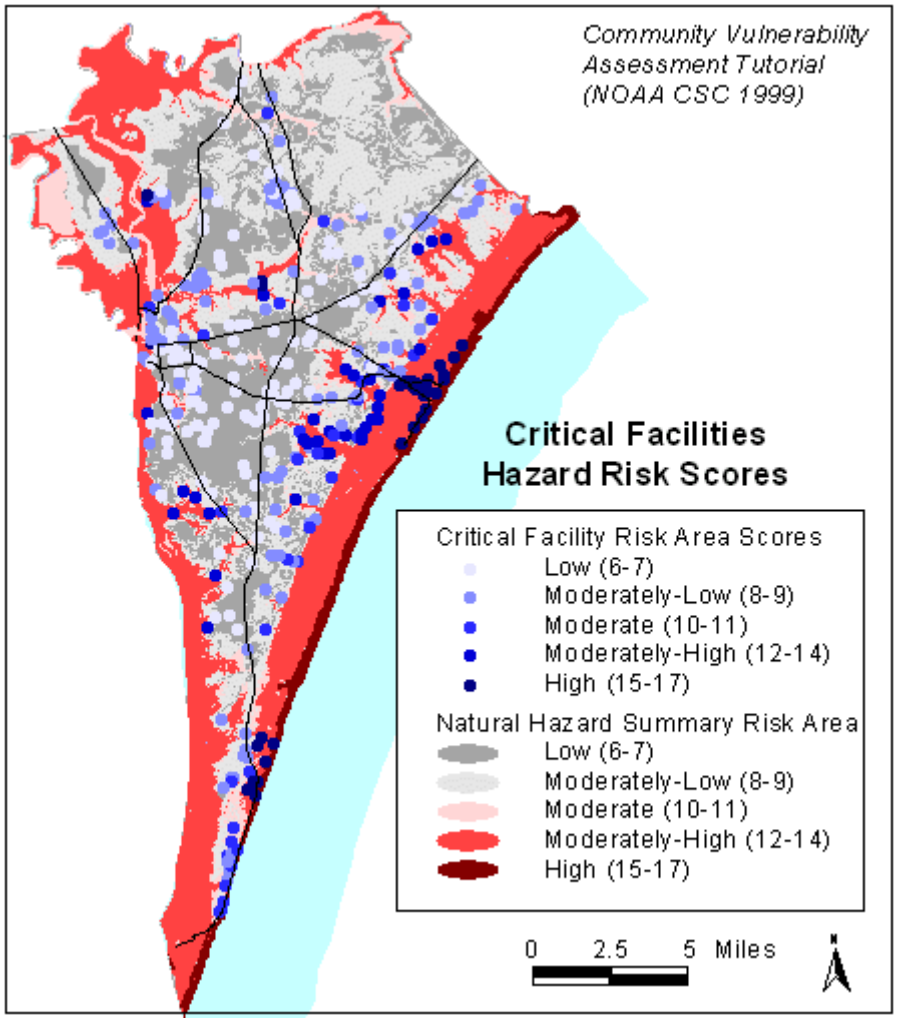


Figure 3.18

The map above depicts the hazard risk scores of New Hanover County's critical facilities.

Step 3d: Conduct vulnerability assessment on all critical facilities.

For each critical facility, conduct an individual assessment addressing the location of the facility relative to the hazard risk areas and the potential vulnerability of the facility to the impacts of each hazard. The facility assessment should be designed with questions that address the elements of vulnerability you are most concerned about and the results should be weighted accordingly (i.e., structural vulnerability vs. operational vulnerability.) If you are focusing on minimizing repetitive losses, you may wish to investigate damage history.

To help you keep the assessment manageable, you may choose to conduct a detailed structural analysis focused on only one or two of the primary hazard threats. Whatever the case, it is important to design questions that are appropriate for the intended audience or investigators. Some questions may require professionally trained inspectors or engineers while others may rely on subjective evaluations from facility managers or owners (see example).

After the critical facilities inventory has been completed, an analysis should be performed to determine the vulnerability of each critical facility to the various hazards. For each hazard being addressed in New Hanover County, the critical facilities were evaluated for hazard risks, along with damage history and structural and operational vulnerability. The facility vulnerability assessment form is shown below.

Notice that tornado hazards have been deleted from New Hanover County's hazard list for this assessment since it is not one of the hazards being addressed from a structural hazard mitigation standpoint. The assessment items are explained below:

- **Facility Name -** Identify the facility by its unique name or identifying code for purposes of incorporating data into critical facility database.
- **Critical Facility Category -** Identify the category for purposes of analysis by type of critical facility.
- **Hazard Category Priority Score -** From Step 1b, enter the relative priority matrix total for each of the hazards being addressed.
- **Risk Consideration Area Score -** From Step 2b, enter the scores for each hazard risk consideration area where the facility is located.
- **Damage History Score -** Based on historical records or personal accounts, identify any known previous damages caused specifically by each of the hazards. This should help give a clear indication of vulnerability based on past experience. The scoring range in this category is higher than that in the structural and operational categories because the determination is less subjective and serves as direct proof of vulnerability.
- **Structural Vulnerability Score -** This item requires some knowledge about the construction of the facility and the existing building codes governing local

construction. While this assessment is rather subjective, it is a first-level effort at identifying facilities that require more thorough structural investigation.

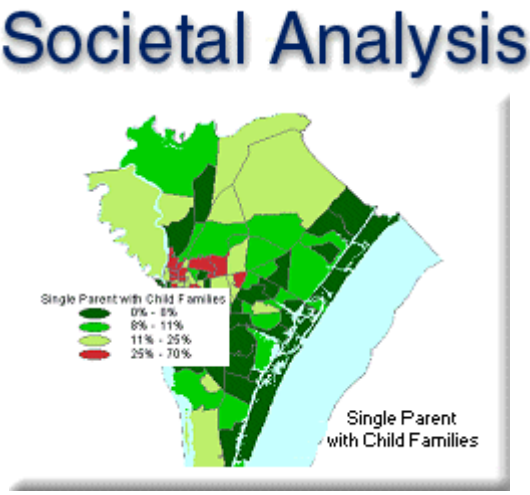
- **Operational Vulnerability Score -** This item will aid in the prioritization of hazard mitigation activities. By defining the potential operational impacts from each hazard, the highest scores should be given to the most catastrophic or life-threatening impacts. Loss of facilities alone (especially if some redundancy is available) does not necessarily constitute significant loss of operational capability.
- **Facility Vulnerability Score -** The items should be totaled to determine an overall score. Although individual item scores should be compared to establish trends and identify specific deficiencies, the total score can help establish a broad prioritization option.
- **Vulnerability Determination -** Based on all of the scores for an individual facility, some threshold should be established for determining low, moderate, and high vulnerability. These thresholds will help to establish a focused list of vulnerable critical facilities.

The table below is an example of an assessment that has been conducted for New Hanover County.

Facility Name: *Seagate Volunteer Fire Department*	Flood	Wind	Surge	Earthquake	Wildfire	Erosion	Total
Critical Facilty Category: *Fire & Rescue*							
(1) Hazard Priority	1	2	3	4	5	6	N/A
(2) Risk Consideration Area Score	1	1	2	1	2	0	7
(3) Damage History Score	6	2	0	0	0	0	8
No History = 0							
Minor Damage = 2							
Moderate Damage = 4							
Significant or Repetitive Damage = 6							
(4) Structural Vulnerability Score	1	1	1	1	1	1	6
Exceeds Codes - incorporates							
hazard-specific protections = 0							
Meets applicable codes = 1							
Does not meet applicable codes = 2							
Known deficiencies for hazard = 3							
(5) Operational Vulnerability Score	2	1	0	1	0	0	4
No effect = 0							
Minimal effect = 1							
Significant effect = 2							
Life threatening impact = 3							
Facility Vulnerability Score (Add items 1 through 5)	10	5	3	3	3	1	25

Figure 3.19

Special consideration areas are those locations (preferably at the neighborhood level) where individual resources are minimal and personal resources for dealing with hazards are extremely limited. These are areas that would be most dependent on public resources after a disaster and thus could be good investment areas for hazard mitigation activities. Identify special consideration areas by utilizing existing low-to-moderate income designations for community development grants or by analyzing key census data categories.



Step 4a: Identify areas of special consideration.

Societal vulnerability analysis identifies potential areas of special needs. These areas generally contain higher concentrations of low-to-moderate income households who would be most likely to require public assistance and services to recover from disaster impacts. These special consideration areas are more likely to be uninsured or underinsured for hazard damages and have limited financial resources for pursuing individual hazard mitigation options. These are also areas where other considerations such as mobility, literacy, or language can significantly impact disaster recovery efforts.

Demographic characteristics can be selected to help identify special consideration areas. For example, minority populations may represent areas where special cultural considerations or foreign language interpreters could be needed.

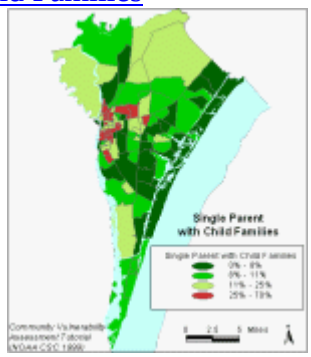
In many cases residents in special consideration areas are renters, rather than homeowners, making the pursuit of structural hazard mitigation even more difficult. The purpose for defining these special consideration areas in a vulnerability assessment is to identify locations for targeting effective hazard mitigation strategies. By focusing on these areas, communities can not only help to reduce the vulnerability of individuals, but can also help reduce the future impacts on public services.

Single parent households may indicate areas where special child care considerations could be necessary. Elderly populations and lack of vehicles may indicate special mobility needs, while low educational attainment rates may indicate the need for specialized help in dealing with disaster assistance procedures. Poverty and public assistance income may indicate areas where even moderate damages could have significant financial impacts on residents.

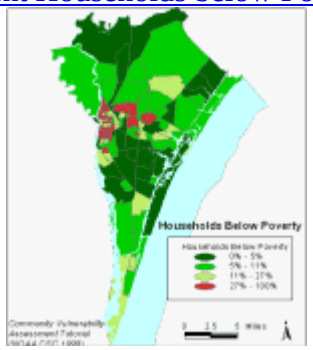
To determine special consideration areas in New Hanover County, publicly available census data at the block group level was used. Eight census data categories were selected as high-need determinant factors:

Census Data Categories

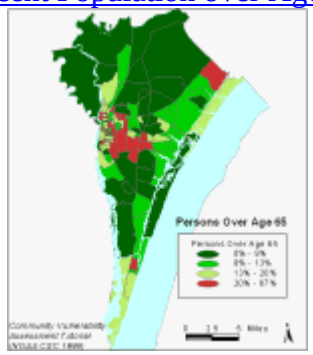
Percent Single Parent with Child Families



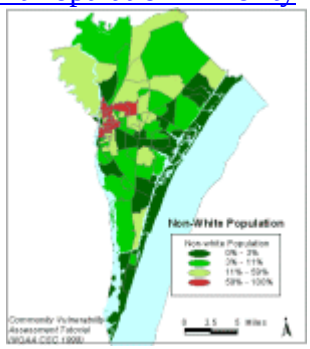
Percent Households below Poverty



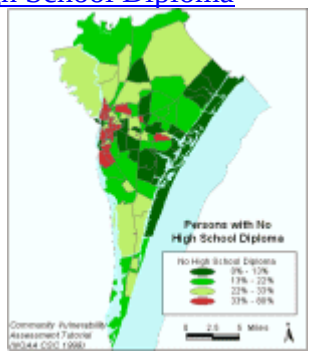
Percent Population over Age 65



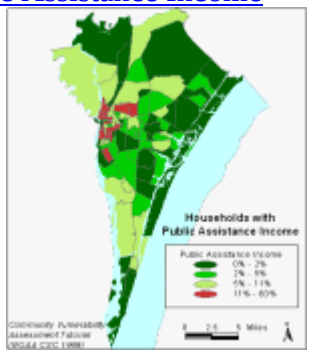
Percent Population Minority



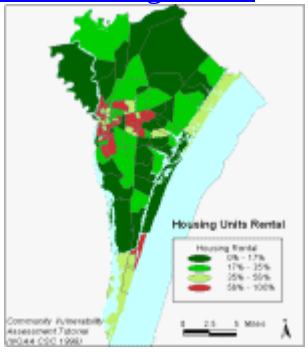
Percent No High School Diploma



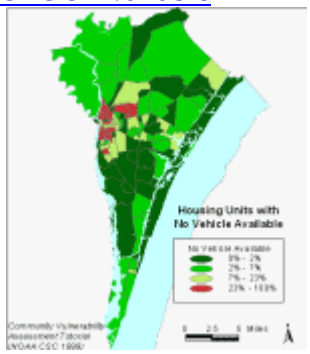
Percent Households with Public Assistance Income



Percent Housing Rental



Percent Housing Units with No Vehicle Available



For each category listed above, New Hanover County block groups were ranked and divided into four quantiles. Those block groups with percentages in the highest quantile were given a score of 4, the second highest quantile were given a score of 3, the third highest were given a score of 2, and the lowest were given a score of 1. After this process was completed for all categories, the scores for each block group were totaled to determine a societal risk summary score.

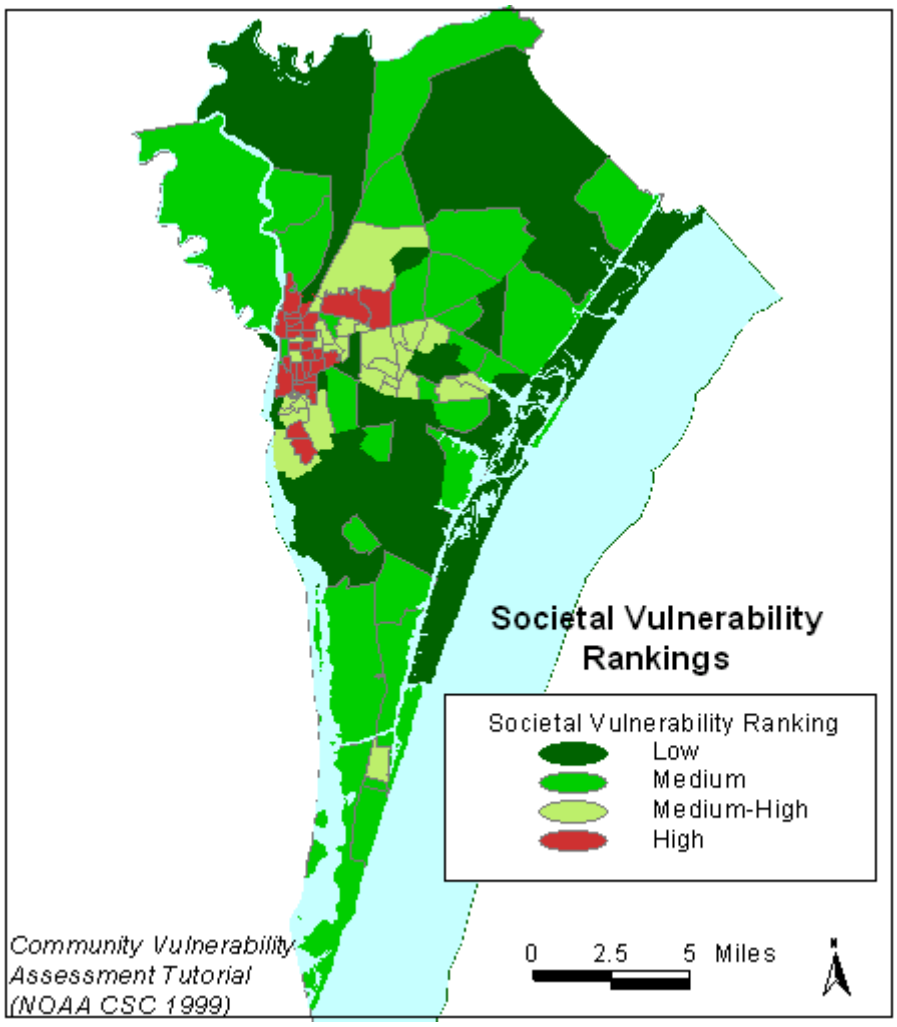


Figure 3.28

The map above represents the societal risk summary rankings. Block groups were again divided into four quantiles with the highest quantile defined as the special consideration areas. The map below highlights the special consideration block groups.

To further target areas for potential hazard mitigation activities, you should identify special consideration areas that are located in high-risk areas. This will also help to determine which mitigation strategies should be focused on the different neighborhoods. Overlay the special consideration neighborhoods with the hazard risk consideration areas.

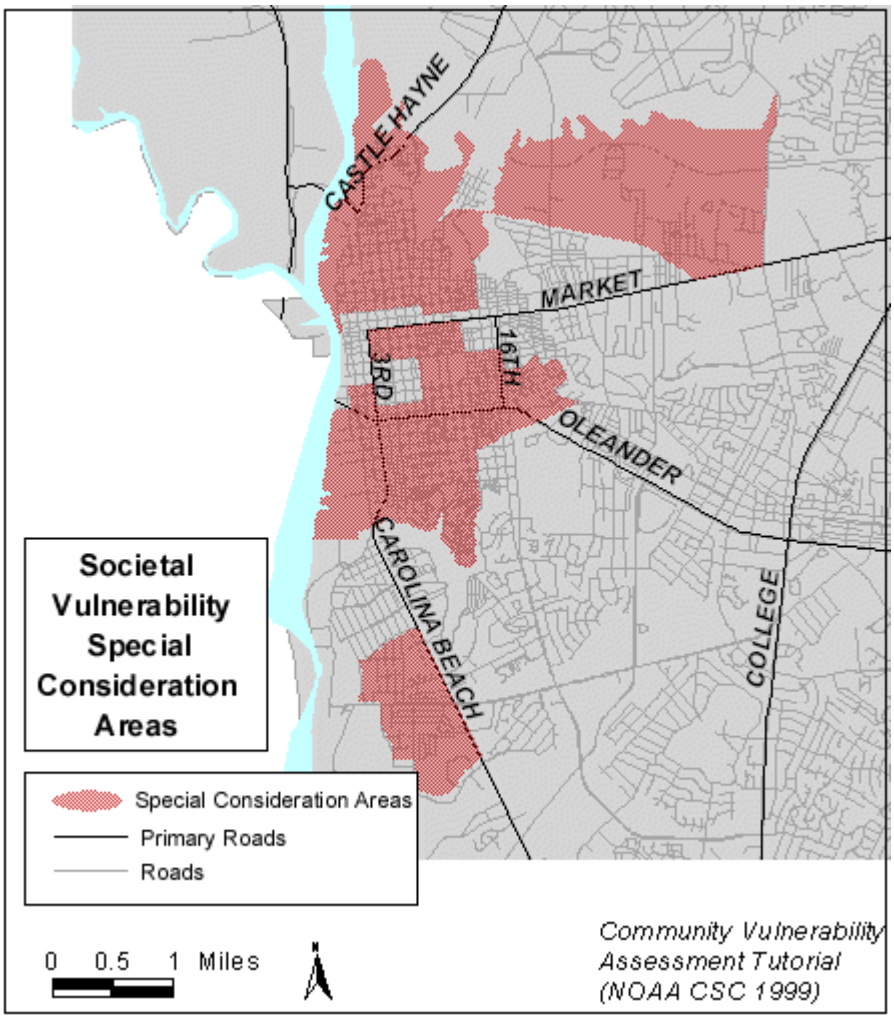


Figure 3.29

Step 4b: Identify intersections of special consideration areas with high-risk areas.

The identification of risk consideration areas within the special consideration block groups helps to assess the overall risks to the population and aids in targeting and prioritizing hazard mitigation options. These block groups in New Hanover County are located in and around the City of Wilmington with relatively small portions located in high hazard risk areas.

The map below shows the relationship between these special consideration block groups and the high hazard risk areas.

To help prioritize potential mitigation options, conduct a general inventory of structures in the special consideration/high-risk intersections. By providing a count of residential units within these areas, you can summarize the special-consideration households to be targeted for assistance and indicate your level of societal vulnerability to each hazard. You may also wish to identify and target these structures for analysis in the future.

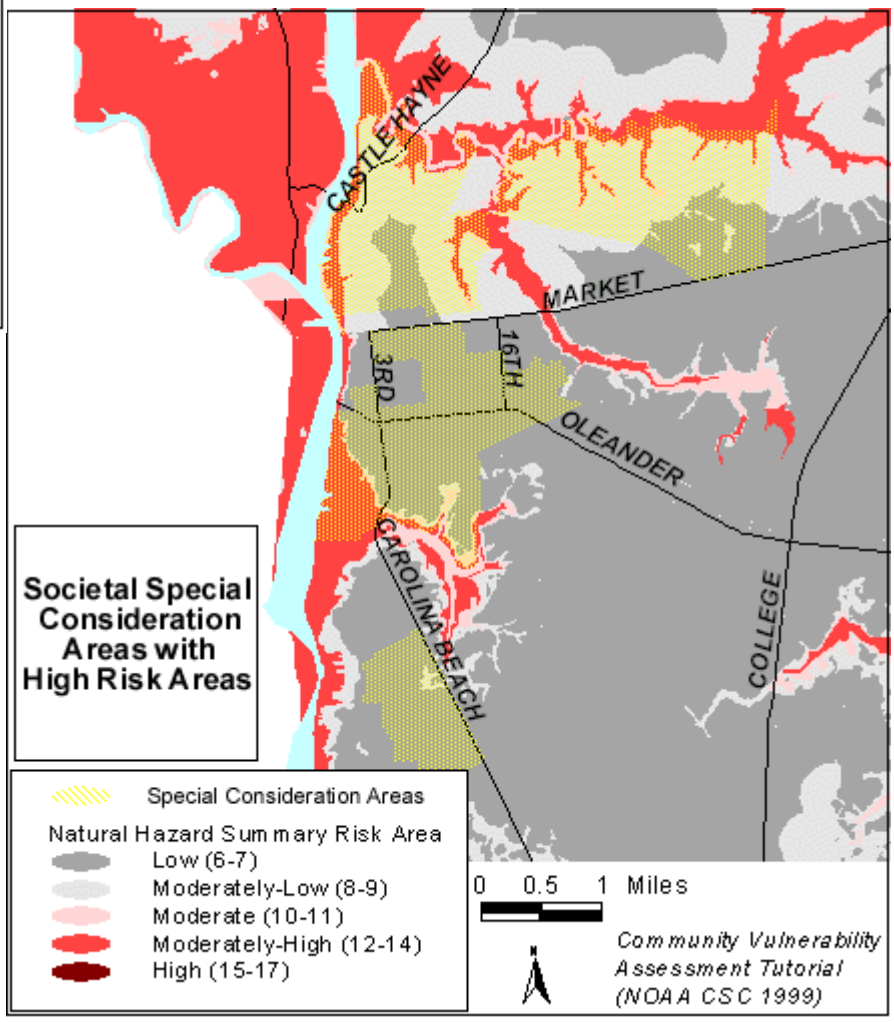


Figure 3.30

Step 4c: Conduct a general inventory of special consideration/high-risk locations.

There are a number of ways to complete this type of inventory. In some cases, communities will choose to conduct a parcel-by-parcel driving survey to determine the number and type of vulnerable facilities in high-risk areas. In New Hanover County, a parcel-based land use inventory was available in a GIS format. This inventory was used to identify the number and type of residential structures located in the special consideration block groups. These residential units were then given scores corresponding to their hazard risk summary scores.

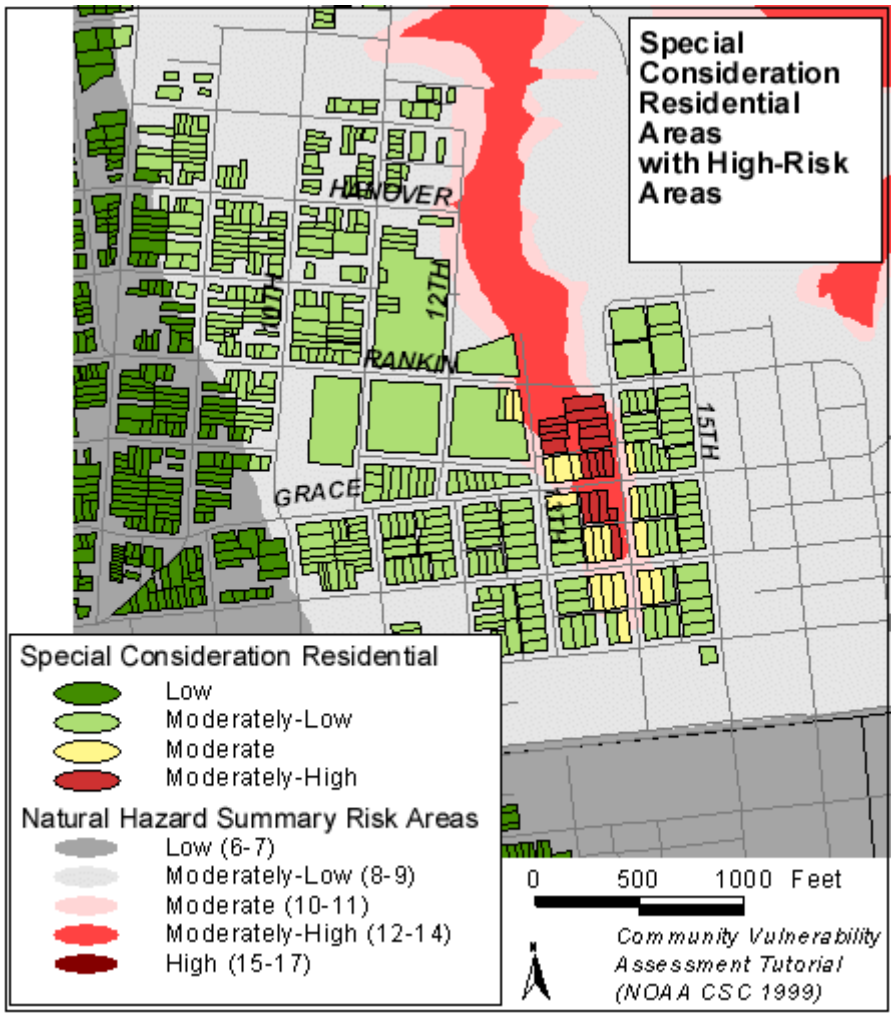
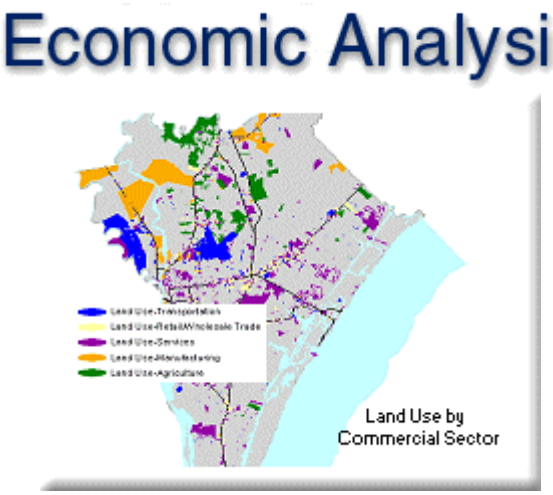

Special Consideration Residential Areas with High-Risk Areas
HANOVER
12TH
RANKIN
GRACE
15TH
Special Consideration Residential
Low
Moderately-Low
Moderate
Moderately-High
Natural Hazard Summary Risk Areas
Low (6-7)
Moderately-Low (8-9)
Moderate (10-11)
Moderately-High (12-14)
High (15-17)
0
500
1000 Feet
Community Vulnerability Assessment Tutorial (NOAA CSC 1999)

Figure 3.31



Step 5a: Identify primary economic sectors and locate economic centers.

The purpose of this analysis is to identify your economic vulnerability to hazard impacts. This first step focuses on identifying the major sectors of your economy and mapping primary centers of activity in those sectors. These economic centers are areas where hazard risks could have major impacts on your local economy and therefore would be ideal locations for targeting certain hazard mitigation strategies.

Identify primary economic sectors and their locations by utilizing local expertise such as the chamber of commerce or economic development council. Economic information can also be derived from widely available data sources such as County Business Patterns or Economic Census. Land use or zoning data can often aid in mapping business and industrial centers.

It is critical for this step to begin with a general overview of your local economy. This economic information will provide some basis for targeting business sector partners in your community-wide hazard mitigation efforts. Some of the most devastating disaster costs to a community include the loss of income associated with business interruptions and the loss of jobs associated with business closures. A progressive community will actively pursue mitigation options to prevent such losses.

Information is widely available to help characterize your local economy. The general economic data used for the New Hanover County case study came from the County Business Pattern (CBP), directly off of the U.S. Census Bureau web page.

The table below provides a general overview of New Hanover County's economy. It illustrates the employment percentages for each of the area's major economic sectors. Information is also available on the employment in various subsets of these economic sectors.

SIC	INDUSTRY	Employees	%Employees	Annual Payroll	Establishments
----	TOTAL	67,260		1,516,529	5,433
07--	AGRICULTURAL SERVICES, FORESTRY, AND FISHING	481	0.7%	6,987	102
10--	MINING	70	0.1%	2,817	4
15--	CONSTRUCTION	5,732	8.5%	124,977	805
20--	MANUFACTURING	8,561	12.7%	329,309	196
40--	TRANSPORTATION AND PUBLIC UTILITIES	4,036	6.0%	108,954	253
50--	WHOLESALE TRADE	3,805	5.7%	103,945	387
52--	RETAIL TRADE	18,484	27.5%	251,398	1,337
60--	FINANCE, INSURANCE, AND REAL ESTATE	3,647	5.4%	87,296	474
70--	SERVICES	22,426	33.3%	500,528	1,855
99--	UNCLASSIFIED ESTABLISHMENTS	18	0.0%	318	20

Figure 3.32

The table below shows the various sub-categories of the economy that employ more than 1,000 persons in New Hanover County. This information provides a more thorough picture of the area's economy.

SIC	INDUSTRY	Employees	Annual Payroll	Establishments
----	TOTAL	67,260	1,516,529	5,433
15--	CONSTRUCTION	5,732	124,977	805
1500	General contractors and operative builders	1,928	45,387	282
1700	Special trade contractors	3,326	68,882	486
20--	MANUFACTURING	8,561	329,309	196
2800	Chemicals and allied products	2,322	111,248	11
3200	Stone, clay, and glass products	1,631	73,937	12
40--	TRANSPORTATION AND PUBLIC UTILITIES	4,036	108,954	253
4200	Trucking and warehousing	1,194	31,192	98
50--	WHOLESALE TRADE	3,805	103,945	387
5000	Wholesale trade - durable goods	2,260	63,565	263
5100	Wholesale trade - nondurable goods	1,459	38,559	119
52--	RETAIL TRADE	18,484	251,398	1,337
5300	General merchandise stores	2,013	25,940	31
5310	Department stores	1,667	20,802	11
5400	Food stores	2,299	26,395	112
5410	Grocery stores	2,080	23,948	75
5500	Automotive dealers and service stations	1,974	54,076	167
5800	Eating and drinking places	7,279	61,106	369
60--	FINANCE, INSURANCE, AND REAL ESTATE	3,647	87,296	474
6000	Depository institutions	1,056	23,841	74
6500	Real estate	1,365	24,314	203
70--	SERVICES	22,426	500,528	1,855
7200	Personal services	1,062	13,896	136
7300	Business services	4,392	79,392	306
7360	Personnel supply services	2,255	41,125	39
8000	Health services	8,280	237,851	330
8600	Membership organizations	1,356	15,443	163
8700	Engineering and management services	1,899	72,302	222

Figure 3.33

Another key step is to identify locations that are primary economic centers of activity. After characterizing your local economy using the information above, you should identify where your primary economic centers are located. This can be easily accomplished in most communities, especially those with clearly defined business and commercial areas. New Hanover County's parcel-based Geographic Information System (GIS) land use inventory

provided a comprehensive assessment of economic sector locations. The map below shows the commercial land use by sector within New Hanover County.

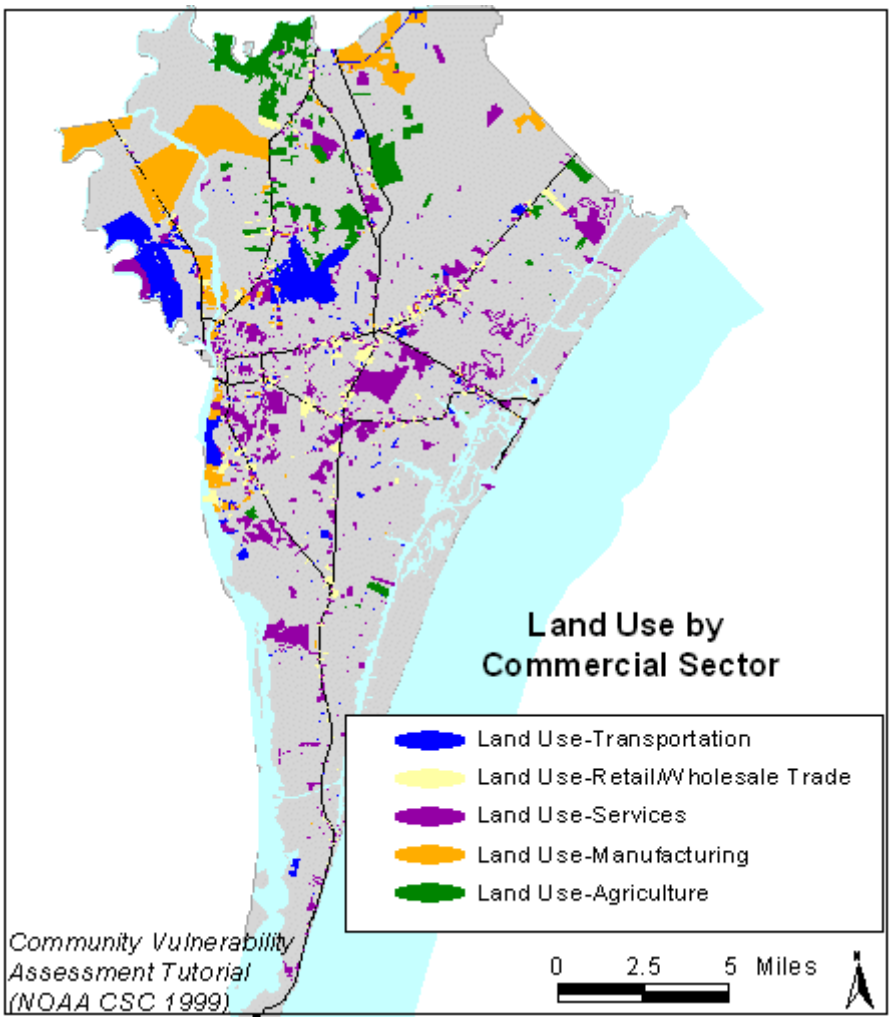


Figure 3.34

The map below illustrates how economic areas are often spread along major highways rather than being concentrated in well-defined core locations. In some cases, zoning classifications such as those above can be used to identify commercial areas.

To further target areas for potential hazard mitigation activities, you should identify economic centers that are located in high-risk areas. Overlay the economic center maps with the hazard risk consideration areas.

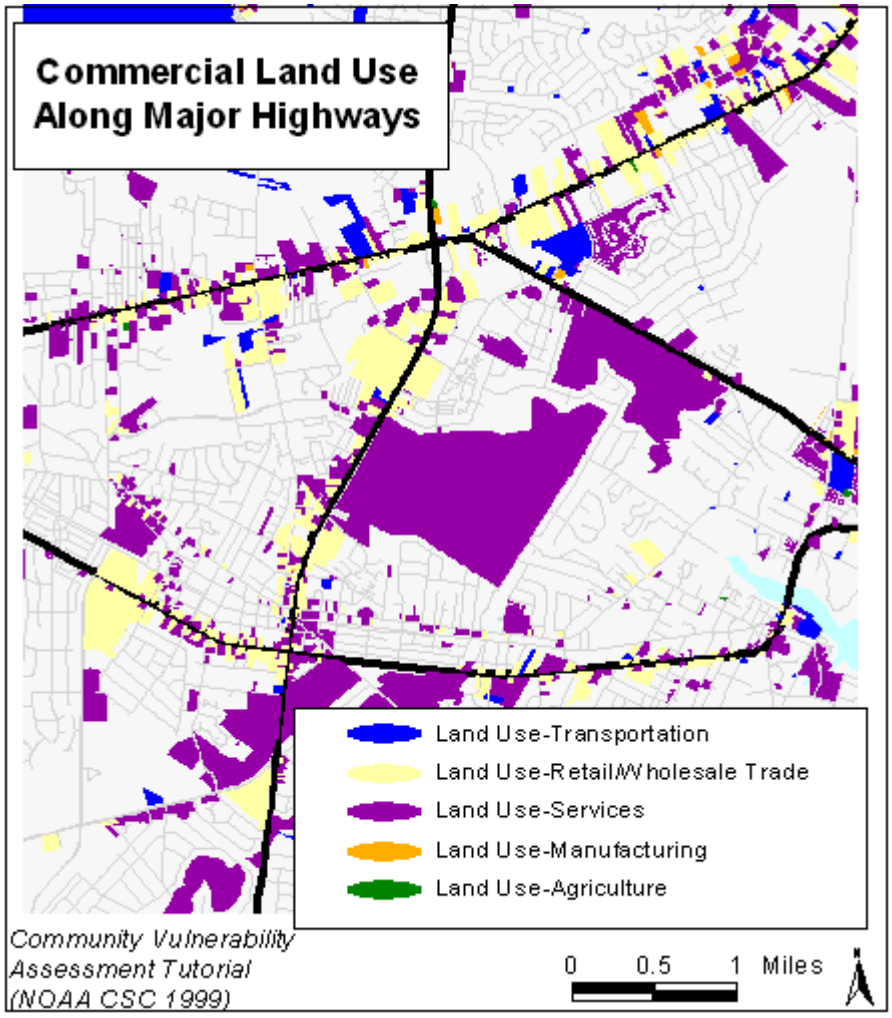
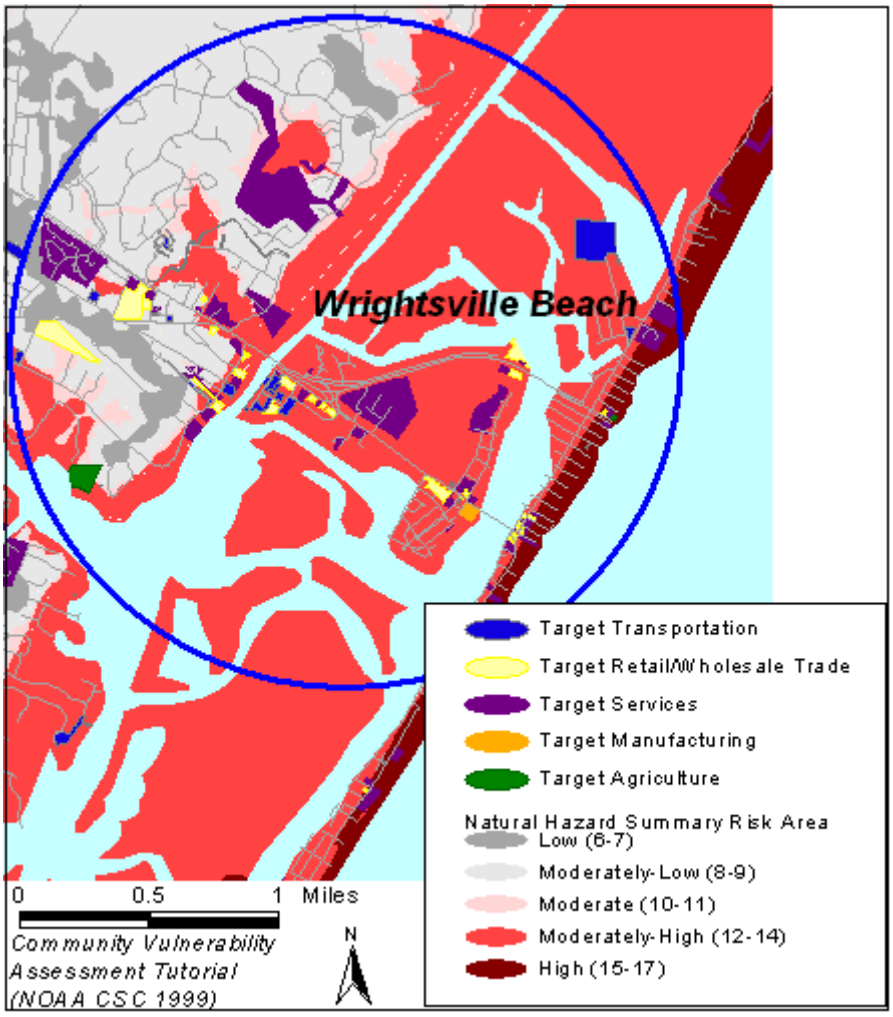


Figure 3.35

Step 5b: Identify intersections of economic centers and high-risk areas.

In Step 5a, you used your community's economic characterization to identify the priority sectors of your economy. Also in Step 5a, you identified your primary economic center locations to help you narrow your economic focus and identify some target commercial areas. Concentrating on your target commercial areas, you now need to identify the risk summary scores associated with key business and industry locations.

The maps below show the relationship between several of New Hanover County's target commercial areas and the summary hazard risk areas.


Wrightsville Beach
Target Transportation
Target Retail/Wholesale Trade
Target Services
Target Manufacturing
Target Agriculture
Natural Hazard Summary Risk Area
Low (6-7)
Moderately-Low (8-9)
Moderate (10-11)
Moderately-High (12-14)
High (15-17)
0
0.5
1 Miles
N
Community Vulnerability Assessment Tutorial (NOAA CSC 1999)
Figure 3.36

To help prioritize potential mitigation options, conduct a general inventory of structures in the economic center/high-risk intersections. By providing a count of business units within these areas, you can summarize the commercial units to be targeted and indicate your level of economic vulnerability to each hazard. You may also wish to identify and target these businesses for structural analysis in the future.

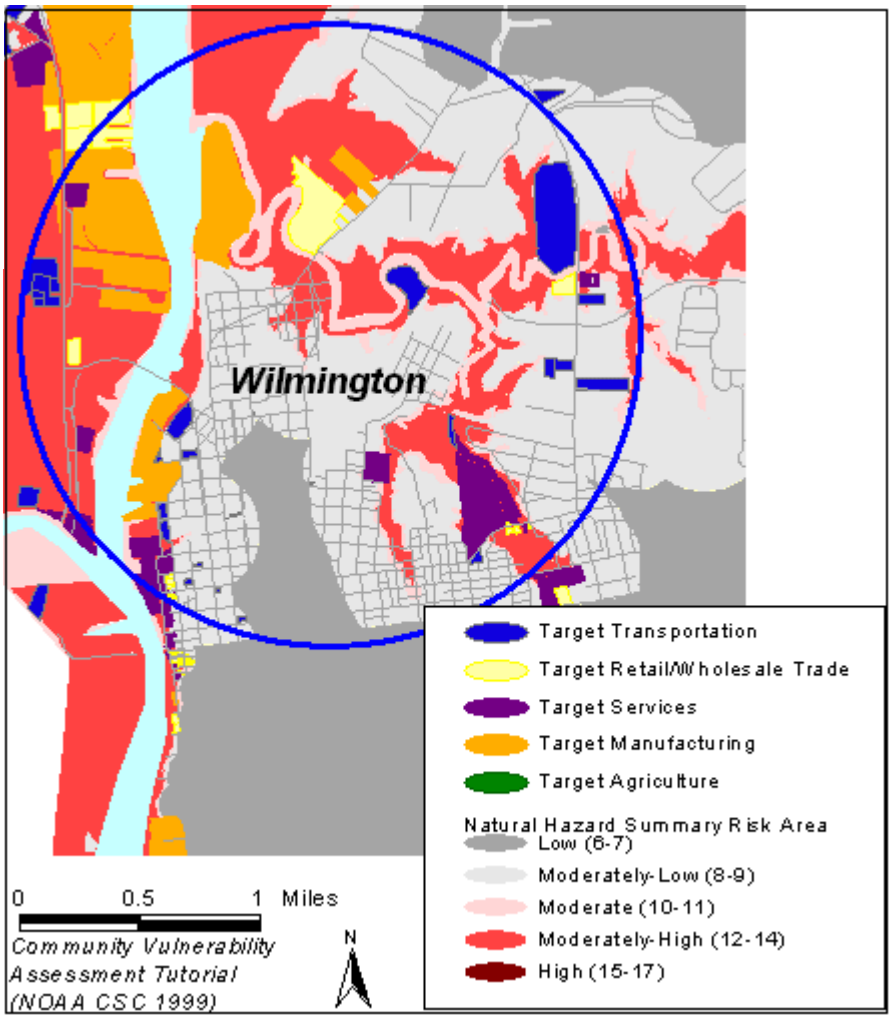


Figure 3.37

Step 5c: Conduct general inventory of high-risk economic centers.

There are several methods that could be used to complete this type of inventory. In some cases, communities will choose to conduct a parcel-by-parcel driving survey to determine the number and type of vulnerable facilities in high-risk areas. In New Hanover County, the commercial section of the parcel-based land use inventory was available in a GIS format. This database was used to identify the number and type of commercial operations located in hazard risk areas.

The table below provides an overview of the commercial land use within the high-risk summary areas. It can be used to identify key businesses as potential hazard mitigation partners. More specifically, those businesses operating in the community's key economic sectors can be prioritized as critical partners and targeted in educational outreach activities.

COUNT	LAND_USE	RISK_SUM
6	Services	17
6		17
21	Services	16
16	Retail/Wholestale Trades	16
2	Agriculture	16
39		16
46	Services	15
19	Retail/Wholestale Trades	15
6	Transportation	15
71		15
97	Services	14
46	Retail/Wholestale Trades	14
13	Manufacturing	14
90	Transportation	14
103	Agriculture	14
349		14
94	Services	13
30	Retail/Wholestale Trades	13
5	Manufacturing	13
59	Transportation	13
5	Agriculture	13
193		13
40	Services	12
18	Retail/Wholestale Trades	12
5	Manufacturing	12
9	Transportation	12
1	Agriculture	12
73		12
124	Services	11
15	Retail/Wholestale Trades	11
2	Manufacturing	11
8	Transportation	11
8	Agriculture	11
157		11
106	Services	10
24	Retail/Wholestale Trades	10
1	Manufacturing	10
16	Transportation	10
5	Agriculture	10
152		10

Figure 3.38

Step 5d: Identify large employers and their intersection with hazard risk areas.

By identifying your community's largest employers, you can target a few key business and industry partners for your hazard mitigation efforts. Economic census data can help you identify employment numbers by economic sector and determine your size threshold. Local experts can identify the employers and their locations. Overlay large employer locations with hazard risk consideration areas.

In addition to identifying your community's primary economic sectors, you should also attempt to target single businesses that employ large numbers of residents. Most communities can easily identify their largest employers. It is possible to narrow down your search with some quantitative statistics such as those shown in the table below. Additional information from local economic development agencies or chamber of commerce can also be helpful. The location and risk scores of very large employers can then be used to prioritize these businesses as potential hazard mitigation partners.

The table below uses CBP data to help identify New Hanover County's largest employers.

SIC	INDUSTRY	100-499 Employees	>500 Employees
----	TOTAL	79	6
15--	CONSTRUCTION	2	0
1510	General building contractors	1	0
1730	Electrical work	1	0
20--	MANUFACTURING	13	3
2323	Men's and boys' neckwear	1	0
2439	Structural wood members, n.e.c.	1	0
2449	Wood containers, n.e.c.	1	0
2657	Folding paperboard boxes	1	0
2710	Newspapers	1	0
2819	Industrial inorganic chemicals, n.e.c.	1	1
2834	Pharmaceutical preparations	1	0
2865	Cyclic crudes and intermediates	1	0
2869	Industrial organic chemicals, n.e.c.	1	0
3230	Products of purchased glass	0	1
3531	Construction machinery	1	0
3535	Conveyors and conveying equipment	1	0
3714	Motor vehicle parts and accessories	1	0
3724	Aircraft engines and engine parts	0	1
399\	Administrative and auxiliary	1	0
40--	TRANSPORTATION AND PUBLIC UTILITIES	3	1
4210	Trucking and courier services, except air	1	0
4491	Marine cargo handling	1	1
4910	Electric services	1	0
50--	\WHOLESALE TRADE	1	0
5136	Men's and boys' clothing	1	0
52--	RETAIL TRADE	25	0
5210	Lumber and other building materials	1	0
5310	Department stores	7	0
5390	Misc. general merchandise stores	1	0
5410	Grocery stores	5	0
5510	New and used car dealers	1	0
5812	Eating places	9	0
599\	Administrative and auxiliary	1	0
60--	FINANCE, INSURANCE, AND REAL ESTATE	4	0
6030	Savings institutions	1	0
6510	Real estate operators and lessors	1	0
6552	Subdividers and developers, n.e.c.	1	0
679\	Administrative and auxiliary	1	0
70--	SERVICES	31	2
7010	Hotels and motels	2	0
7213	Linen supply	1	0
7218	Industrial launderers	1	0
7291	Tax return preparation services	1	0
7349	Building maintenance services, n.e.c.	1	0
7363	Help supply services	6	0
7381	Detective and armored car services	1	0
8010	Offices and clinics of medical doctors	3	0
8049	Offices of health practitioners, n.e.c.	1	0
8050	Nursing and personal care facilities	5	0
8060	Hospitals	0	2
8080	Home health care services	5	0
8210	Elementary and secondary schools	1	0
8640	Civic and social associations	1	0
8711	Engineering services	1	0
8731	Commercial physical research	1	0

Figure 3.39

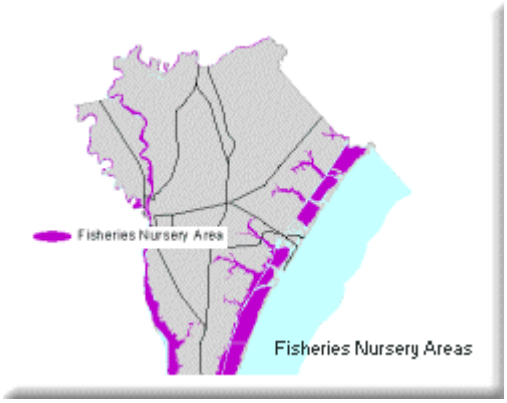
Step 5e: Conduct vulnerability analysis on structures of large employers as critical facilities.

Consider enlisting all large employers as partners in your vulnerability assessment and hazard mitigation activities. If possible, add these businesses to your critical facilities list and conduct detailed assessments of vulnerability on these structures.

While this step is largely up to the private sector, it is recommended that vulnerability assessments for large employers be addressed in a manner similar to critical facilities. You can take the first step by engaging key private sector establishments in hazard mitigation partnerships and asking them to assess their structural and operational vulnerability to hazards. At a minimum, the process you follow for analyzing the vulnerability of critical facilities can provide a guide for similar private sector activities.

The purpose of this analysis is to identify locations where there is potential for secondary environmental impacts from natural hazards and to target vulnerable locations for hazard mitigation activities. Identify key sites in your community where hazardous or toxic materials are stored or there is potential for hazardous spills or discharges.

Environmental Analysis



Step 6a: Identify secondary hazard risk consideration sites.

In New Hanover County, the following types of facilities were included as secondary hazard risk consideration sites:

- Toxic Release Inventory Sites
- Solid Waste Facilities
- Oil Facilities
- National Pollutant Discharge Elimination System (NPDES) Permitted Sites
- Hazardous Substance Disposal Sites

Other types of facilities that you may want to include in this analysis could range from nuclear power plants to underground storage tanks.

To further target areas for potential hazard mitigation activities, you should identify secondary risk sites that are located in high natural hazard risk areas. Overlay the environmental sites with the hazard risk consideration areas.

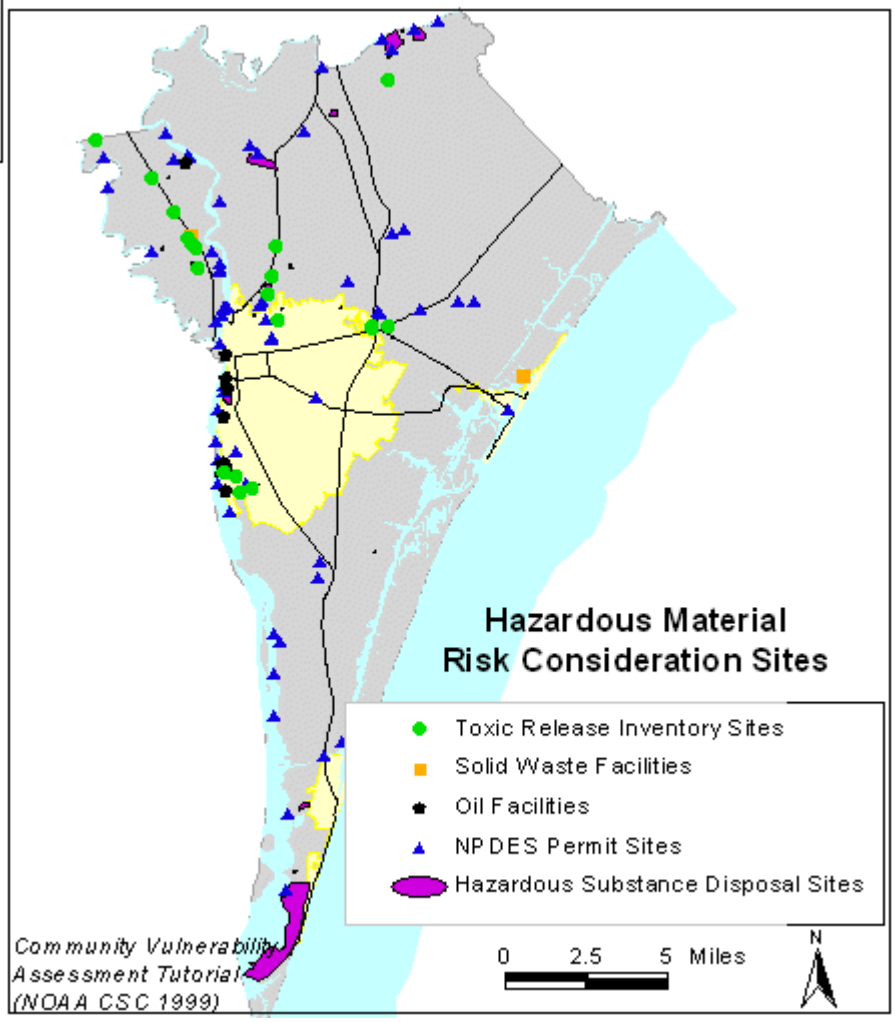


Figure 3.40

Step 6b: Identify intersections of secondary risk sites and natural hazard risk consideration areas.

To help determine the threat from natural hazards to your secondary risk sites you now need to identify the risk summary scores associated with each of these locations.

To prioritize secondary risk sites for potential hazard mitigation, you should identify significant environmental resource locations, particularly those that would be sensitive to secondary hazard impacts. You will want to use the proximity of these environmentally sensitive locations to the secondary risk sites to determine the overall risks from these facilities.

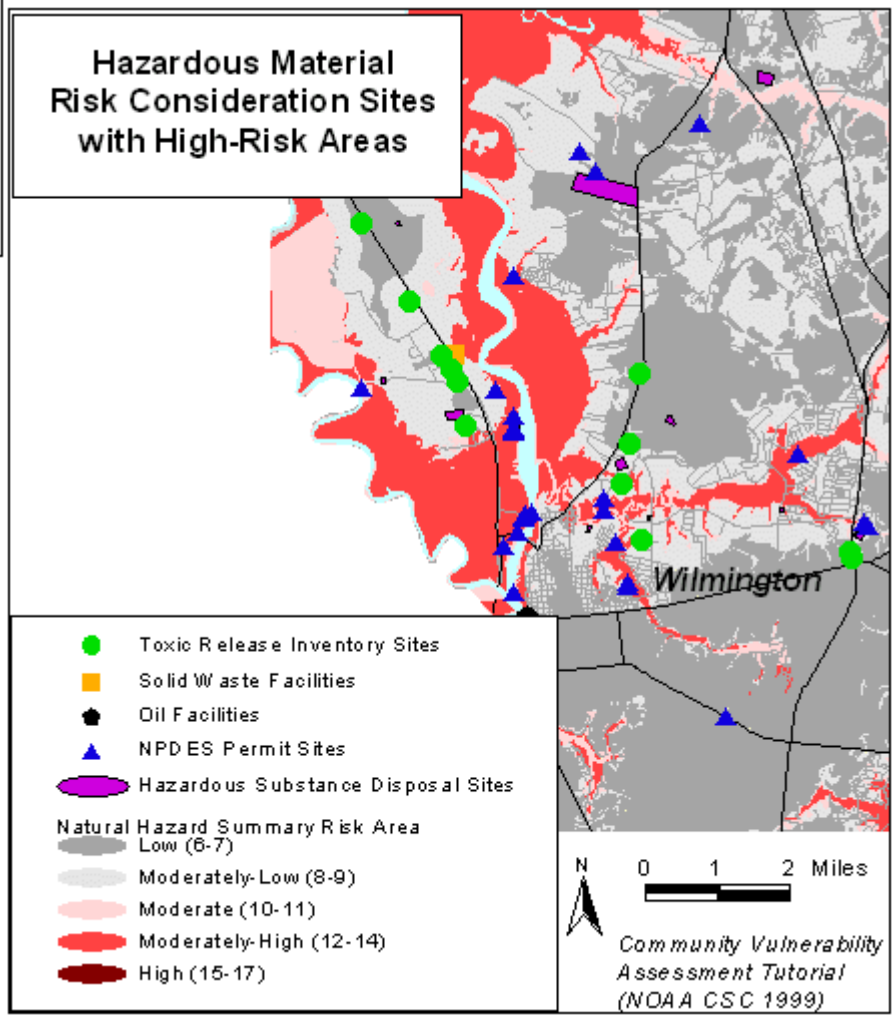
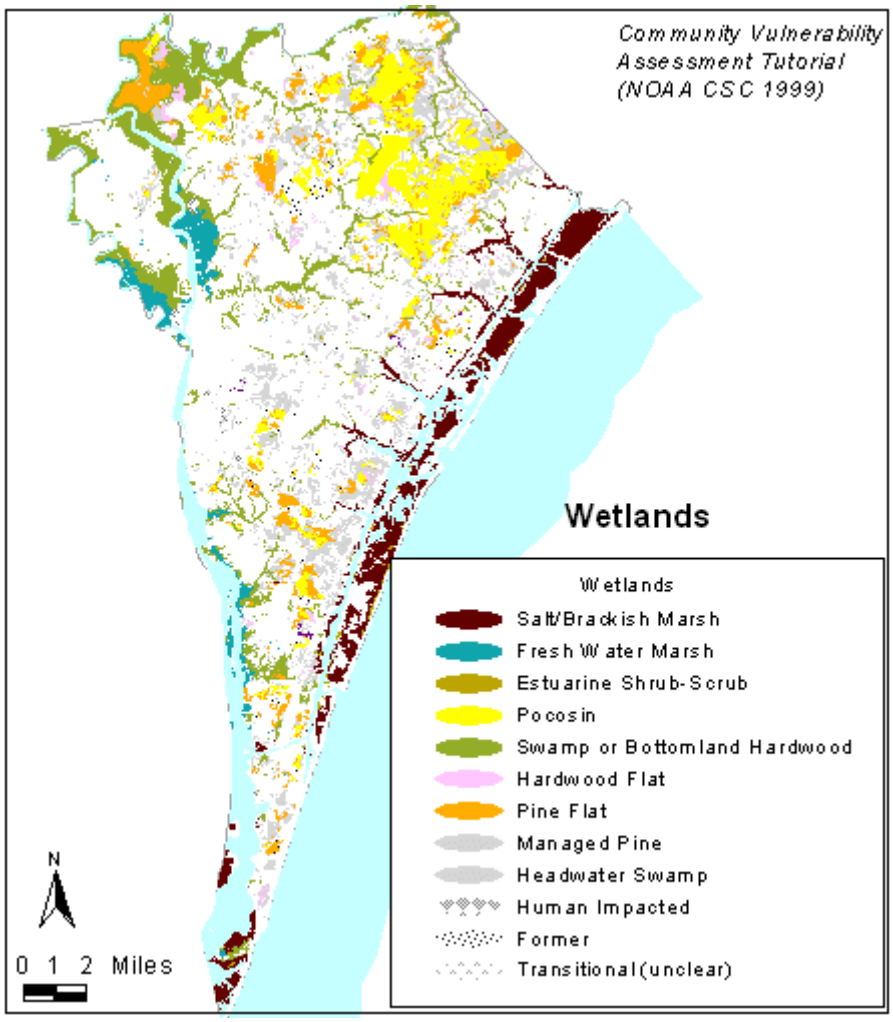
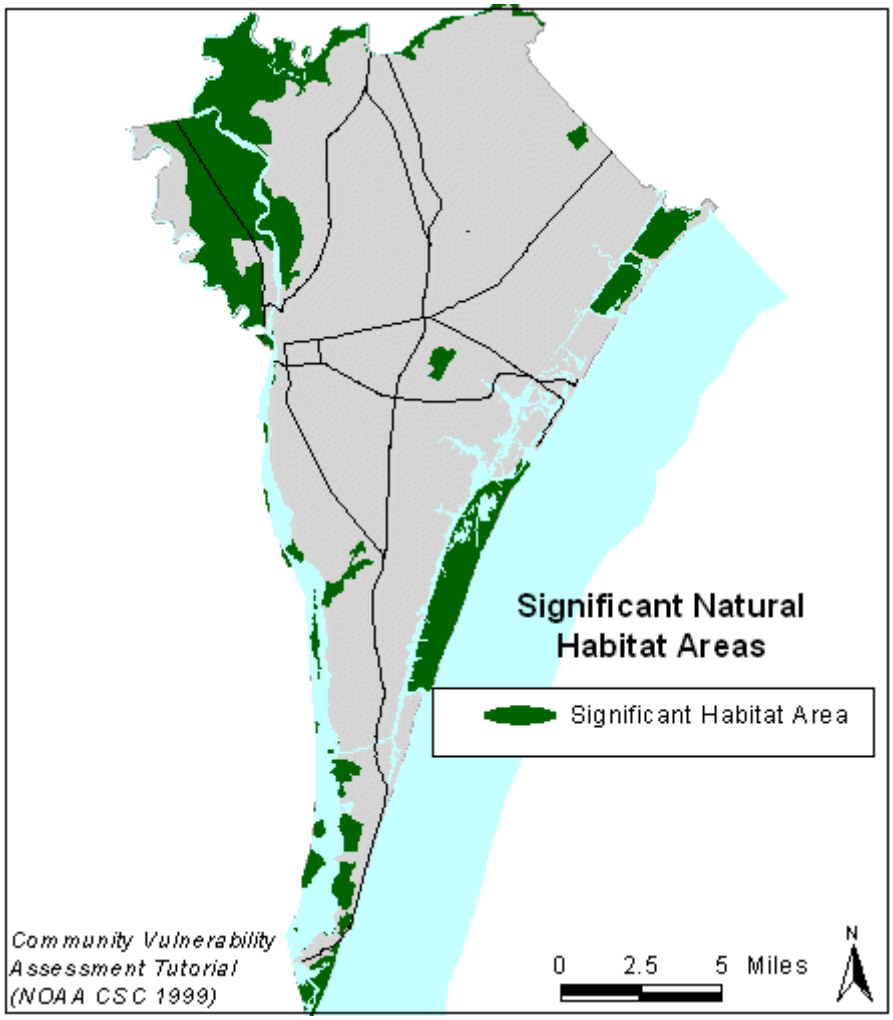


Figure 3.41

Step 6c: Identify key environmental resource locations and their proximity to secondary risk sites.

The environmental resource sites identified for New Hanover County include wetlands, significant habitat areas, and fisheries nursery areas. A 1/8-mile buffer was created around the secondary risk sites to determine which of the environmental resource areas would be considered “at risk” from secondary hazard impacts. Similar to using the summary risk scores to target high-risk facilities, the proximity to environmental resource areas can be used to prioritize these secondary risk sites.


Community Vulnerability
Assessment Tutorial
(NOAA CSC 1999)
Wetlands
Wetlands
Salt/Brackish Marsh
Fresh Water Marsh
Estuarine Shrub-Scrub
Pocosin
Swamp or Bottomland Hardwood
Hardwood Flat
Pine Flat
Managed Pine
Headwater Swamp
Human Impacted
Former
Transitional (unclear)
N
0 1 2 Miles
Figure 3.42


Significant Natural
Habitat Areas
Significant Habitat Area
Community Vulnerability
Assessment Tutorial
(NOAA CSC 1999)
0
2.5
5 Miles
N
Figure 3.43

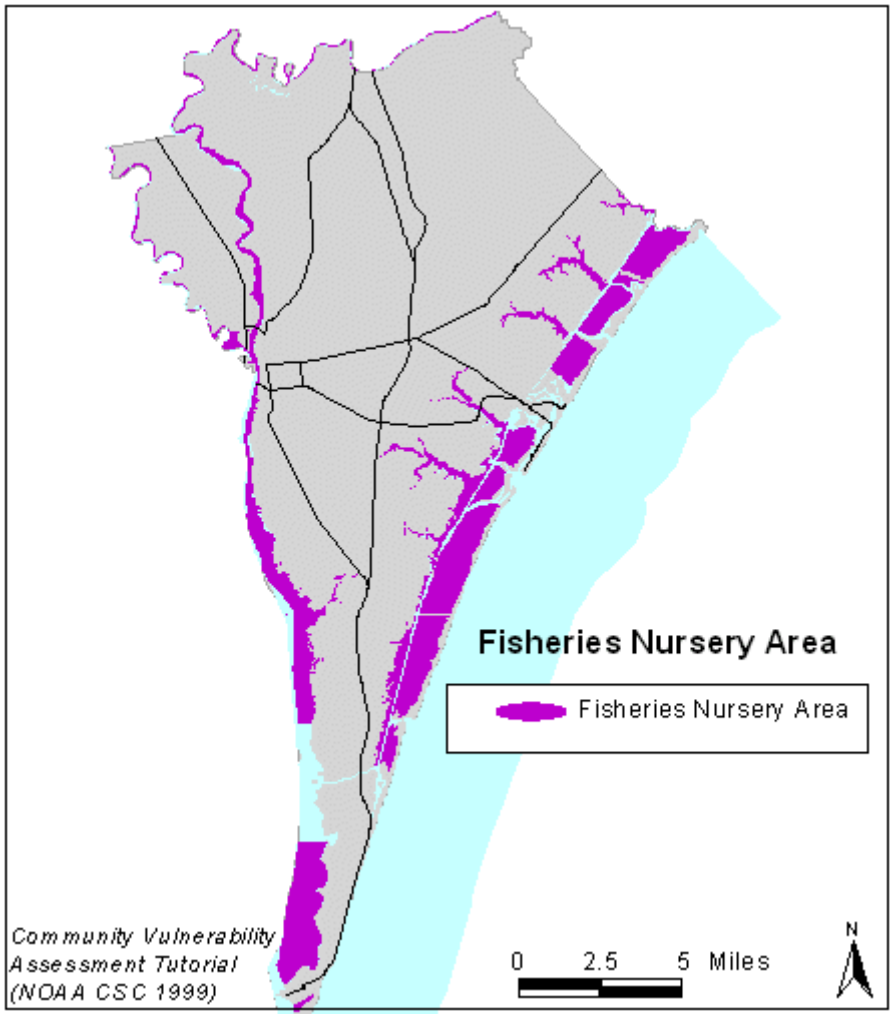


Figure 3.44

The table below identifies both the risk summary scores and the number of environmental resource areas associated with each of the secondary risk sites.

FACILITY TYPE	COUNT	RISK_SUM	ENVIRONMENTAL SENSITIVITY
NPDES Permit Site	2	14	3
NPDES Permit Site	9	14	2
NPDES Permit Site	6	14	1
Solid Waste Facility	1	14	1
NPDES Permit Site	1	14	0
Total	19	14	
NPDES Permit Site	1	13	3
Hazardous Substance Disposal Site	3	13	3
NPDES Permit Site	3	13	2
Oil Facility	1	13	2
NPDES Permit Site	3	13	1
Hazardous Substance Disposal Site	1	13	1
Oil Facility	1	13	1
NPDES Permit Site	1	13	0
Oil Facility	1	13	0
Total	15	13	
NPDES Permit Site	2	12	2
Total	2	12	
NPDES Permit Site	1	11	3
Oil Facility	1	11	2
NPDES Permit Site	3	11	1
Hazardous Substance Disposal Site	1	11	1
Total	6	11	
NPDES Permit Site	5	10	3
NPDES Permit Site	2	10	2
Hazardous Substance Disposal Site	1	10	2
NPDES Permit Site	3	10	1
Total	11	10	
NPDES Permit Site	7	9	3
Hazardous Substance Disposal Site	1	9	3
NPDES Permit Site	4	9	2
Oil Facility	1	9	2
Toxic Release Inventory Facility	2	9	2
NPDES Permit Site	2	9	1
Hazardous Substance Disposal Site	1	9	1
Toxic Release Inventory Facility	1	9	1
Total	19	9	
Hazardous Substance Disposal Site	2	8	3
NPDES Permit Site	1	8	2
Hazardous Substance Disposal Site	1	8	2
Solid Waste Facility	1	8	2
NPDES Permit Site	3	8	1
Toxic Release Inventory Facility	7	8	1
Hazardous Substance Disposal Site	6	8	0
Oil Facility	1	8	0
Toxic Release Inventory Facility	2	8	0
Total	24	8	
NPDES Permit Site	1	7	2
Hazardous Substance Disposal Site	1	7	2
Oil Facility	2	7	2
NPDES Permit Site	2	7	1
Hazardous Substance Disposal Site	7	7	1
Oil Facility	1	7	1
Toxic Release Inventory Facility	10	7	1
NPDES Permit Site	2	7	0
Hazardous Substance Disposal Site	1	7	0
Oil Facility	1	7	0
Total	28	7	
Hazardous Substance Disposal Site	1	6	1
Toxic Release Inventory Facility	1	6	1
NPDES Permit Site	2	6	0
Toxic Release Inventory Facility	1	6	0
Total	5	6	

Figure 3.45

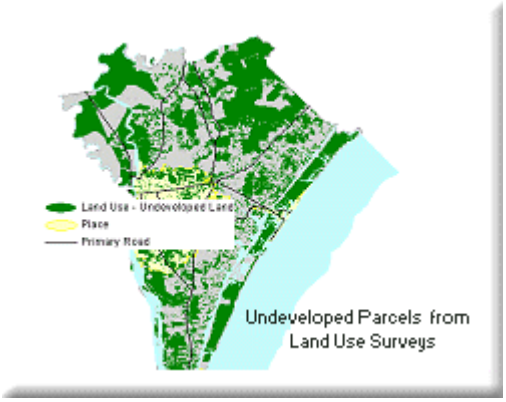
Based on the outcome of the previous step, you should be able to identify environmental hazard sites that are at risk for impacts from natural hazard events. Target these sites as partners in your hazard mitigation activities and add those sites to your critical facilities lists. If possible, conduct detailed assessments of vulnerability on these structures.

Step 6d: Conduct vulnerability analysis on priority secondary risk sites as critical facilities.

While this step is largely up to the private sector, it is recommended that vulnerability assessment for secondary risk sites be addressed in a manner similar to critical facilities. You can take the first step by engaging key private sector establishments in hazard mitigation partnerships and asking them to assess their structural and operational vulnerability to hazards. At a minimum, the process you follow for analyzing the vulnerability of critical facilities can provide a guide for similar private sector activities.

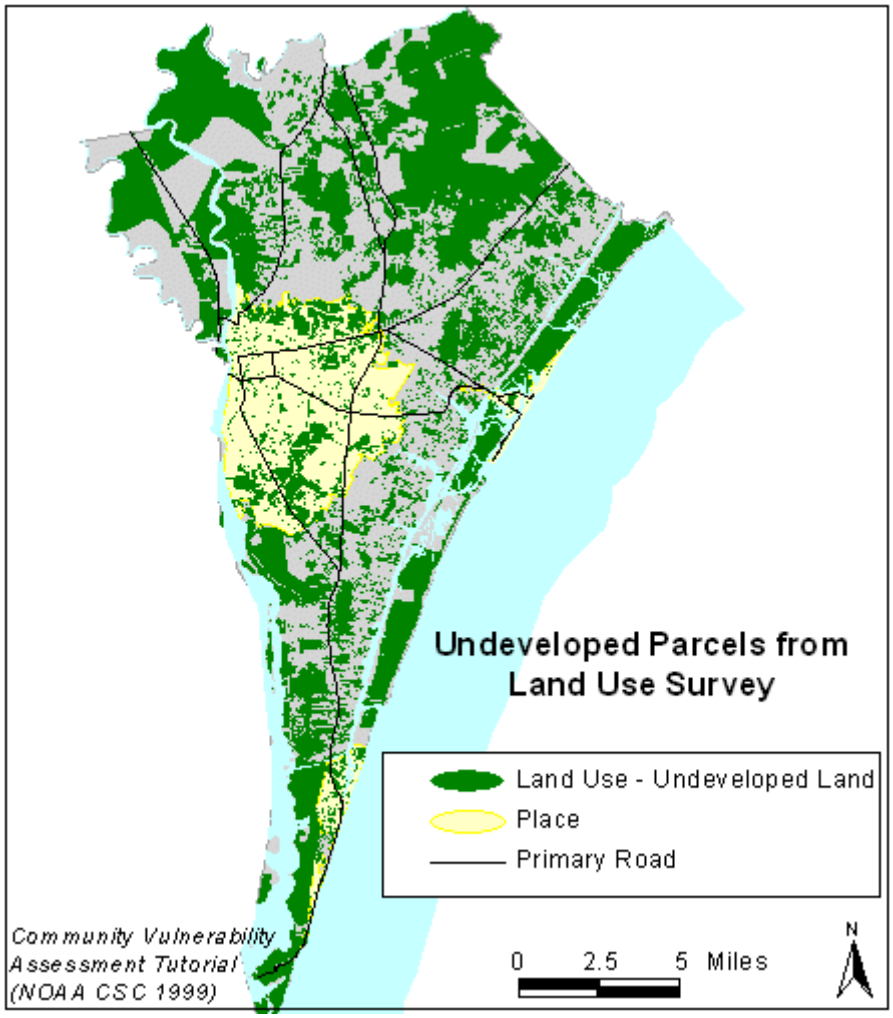
The purpose of this analysis is to identify opportunities beyond the existing built environment for reducing future hazard vulnerability. Identify the large tracts of undeveloped land in your community and, if possible, any future plans for growth. Overlay this information with the risk consideration areas.

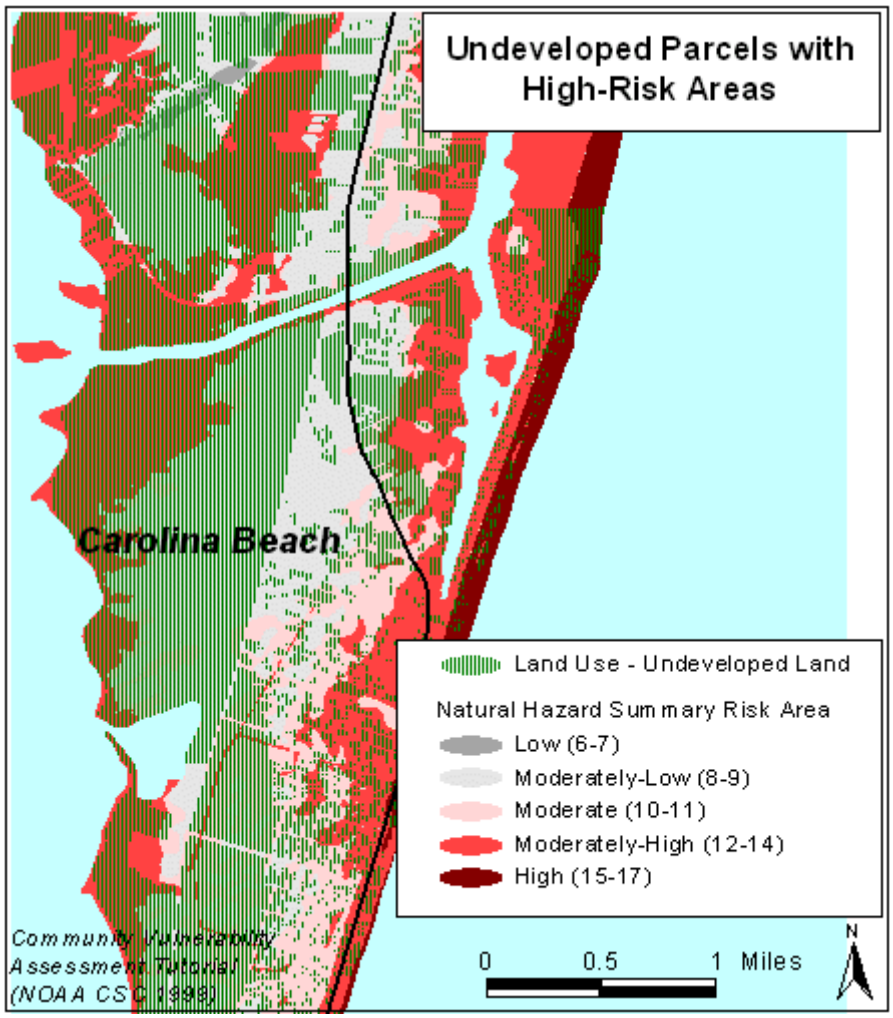
Mitigation Opportunities Analysis



Step 7a: Identify areas of undeveloped land and their intersection with high-risk areas.

New Hanover County's parcel-level land use database was used to identify the county's undeveloped land. By applying risk summary scores to the undeveloped parcels, New Hanover County defined their high-risk undeveloped land areas as potential target areas for future hazard mitigation considerations.


Undeveloped Parcels from
Land Use Survey
Land Use - Undeveloped Land
Place
Primary Road
Community Vulnerability
Assessment Tutorial
(NOAA CSC 1999)
0
2.5
5 Miles
N
Figure 3.46


Undeveloped Parcels with High-Risk Areas
Carolina Beach
Land Use - Undeveloped Land
Natural Hazard Summary Risk Area
Low (6-7)
Moderately-Low (8-9)
Moderate (10-11)
Moderately-High (12-14)
High (15-17)
Community Vulnerability Assessment Tutorial (NOAA CSC 1998)
0
0.5
1 Miles
N
Figure 3.47

Identify the type of land cover, land cover change over time (if possible), and zoning for all undeveloped land in high hazard areas. This information should provide an overview of the potential for future development in high-risk locations. With this information you can develop mitigation strategies that specifically target new development.

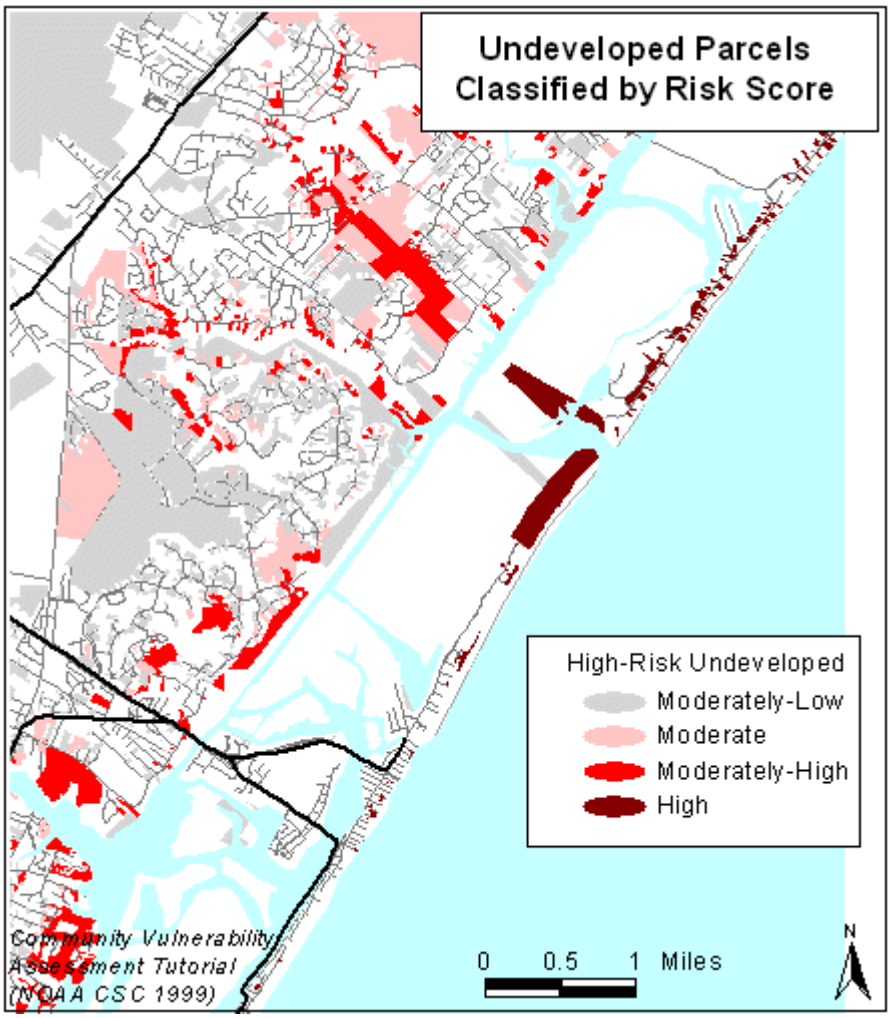


Figure 3.48

Step 7b: Inventory high-risk undeveloped land.

Satellite-based land cover images were used to determine the land cover types for New Hanover County's undeveloped parcels. This information gives you some indication of the type and amount of development potential that exists throughout the county.

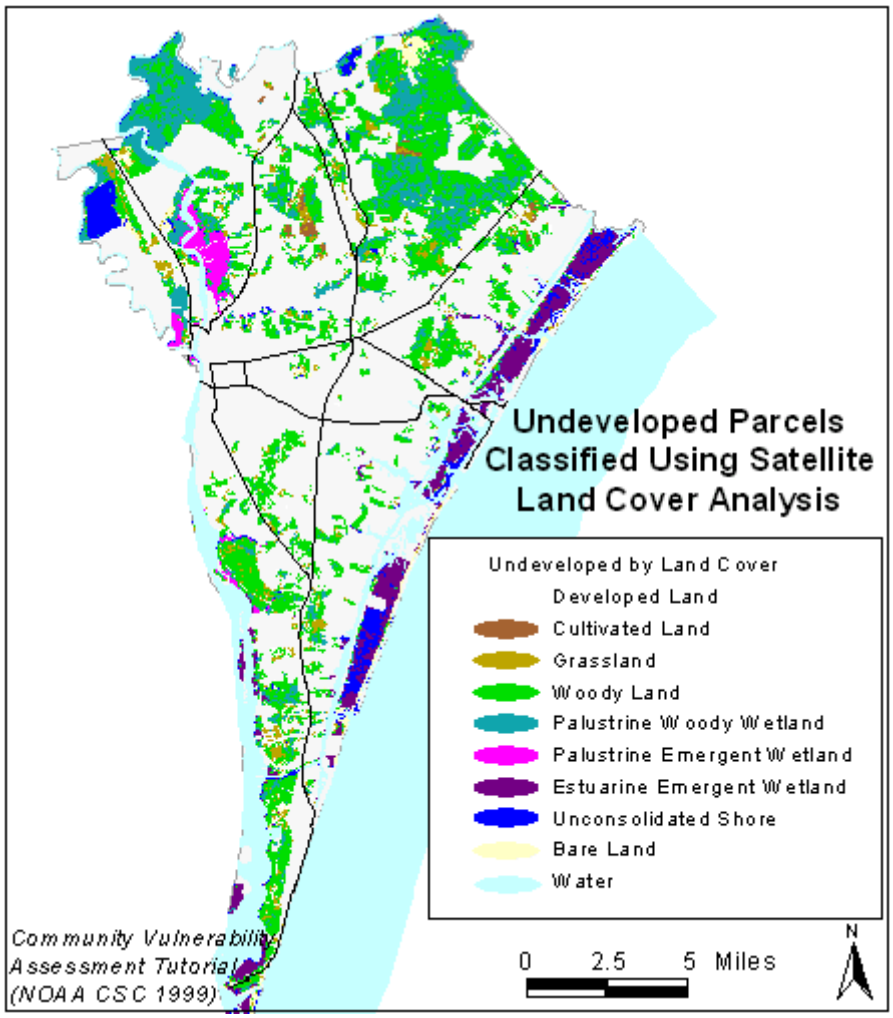


Figure 3.49

LAND COVER CLASS	ACRES
Developed Land	2,564
Cultivated Land	459
Grassland	3,320
Woody Land	24,680
Bare Land	1,703
Unconsolidated Shore	166
Estuarine Emergent Wetland	5,179
Palustrine Emergent Wetland	1,467
Palustrine Woody Wetland	11,315
Water	4,484
Total	**55,337**

Figure 3.50

Zoning classifications can also provide information about the development potential for undeveloped land areas. New Hanover County's zoning designations were used to identify the maximum legal development densities associated with undeveloped land tracts. This information can now be used to identify possible policy changes to minimize development or require additional structural mitigation for future construction in high-risk locations.

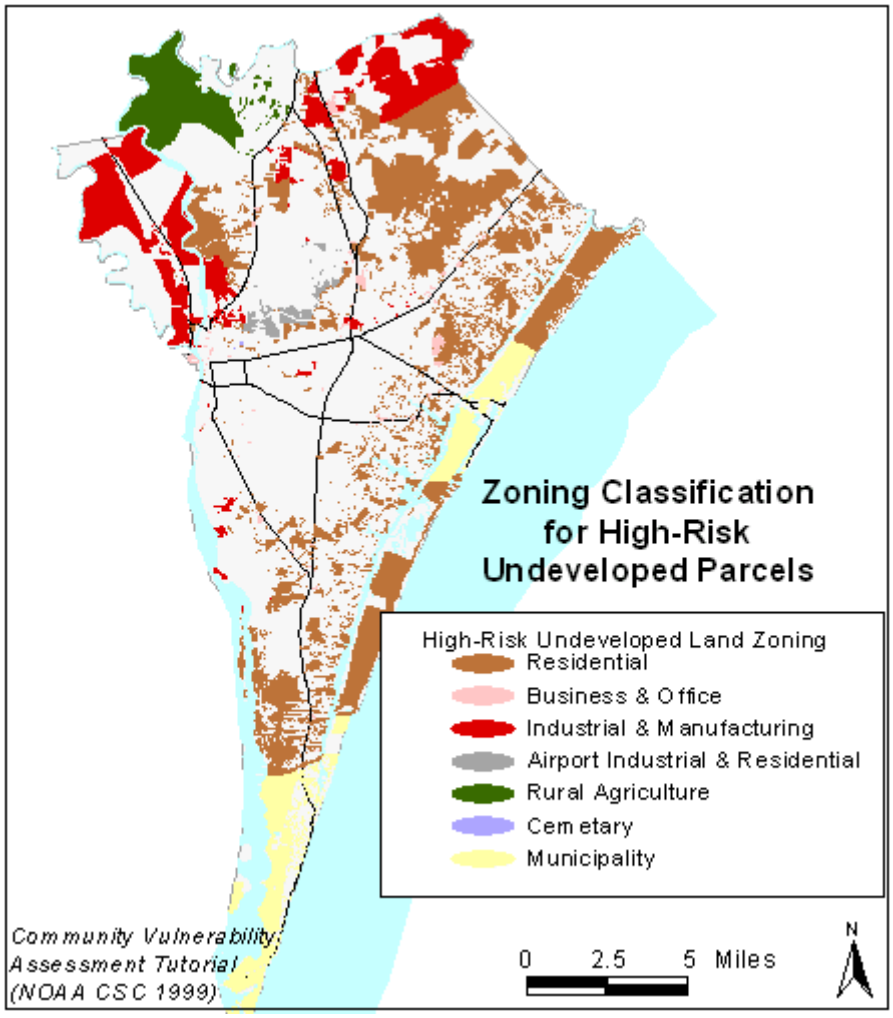


Figure 3.51

Below are the detailed zoning classifications for the undeveloped high-risk parcels. These zoning classifications are a combination of city and county zoning and are intended only for general information purposes. Individual jurisdictions should be contacted for specific parcel-level zoning information.


High-Risk Undeveloped Land Zoning
Airport Industrial & Residential
Airport Industrial District (AI)
Airport Residential District (AR)
Business & Office
Business District (B-1)
Business District (B-2)
Central Business District
Community Business
Community Service
Office and Institutional District (O&I)
Regional Business
Industrial & Manufacturing
Heavy Manufacturing
Light Manufacturing
Industrial District (I-1)
Industrial District (I-2)
Cemetary
Rural Agriculture District (RA)
Municipality
Carolina Beach
Wrightsville Beach
Residential
Historic District
Historic District - Residential
Mobile Home Development
Multi-family High Density
Multi-family Low Density
Multi-family Medium Density
Planned Development District
Residential (10,000 sq/ft lots)
Residential (3,000 sq/ft lots)
Residential (5,000 sq/ft lots)
Residential (7,000 sq/ft lots)
Residential District (R-10)
Residential District (R-15)
Residential District (R-20)
Residential District (R-20S)
Residential District (R15)
Figure 3.52

It is possible to obtain aggregate data on National Flood Insurance Program policies from The Federal Emergency Management Agency (FEMA). By establishing a ratio of policy-holders to households you can identify areas where educational/outreach activities may be targeted as a mitigation strategy.

UNDEVELOPED LAND ZONING	ACRES
Airport Industrial	650
Industrial District (I-1)	408
Industrial District (I-2)	8202
Light Manufacturing	165
Heavy Manufacturing	176
Total Manufacturing/Industrial	**9601**
Business District (B-1)	86
Business District (B-2)	359
Central Business District	20
Community Business	40
Community Service	24
Office and Institutional	139
Planned Development	383
Regional Business	11
Residential/Business (R-15/B-20)	21
Cemetary	11
Total Commercial/Mixed Use	**1094**
Airport Residential	76
Multi-family Medium Density	213
Historic Residential	1
Multi-family Low Density	41
Residential (R-10)	922
Residential (R-15)	16117
Residential (R-20)	7676
Residential (R-20S)	2365
Residential 3,000 sq. ft.	37
Residential 5,000 sq. ft.	15
Residential 7,000 sq. ft.	8
Total Residential	**27,471**
Total Agriculture	**4356**
Total Wrightsville Beach	**2087**
Total Carolina Beach	**4167**

Figure 3.53

Step 7c: Assess the status of your existing flood insurance program participation.

New Hanover County's participation in the National Flood Insurance Program is concentrated primarily along the coast. One of the mitigation strategies that the county may wish to pursue is to target flood insurance education programs in the high-risk areas located in other portions of the county. Other data such as the percentage of mobile homes or the age of the housing

stock can help to further target locations for this type of educational effort.

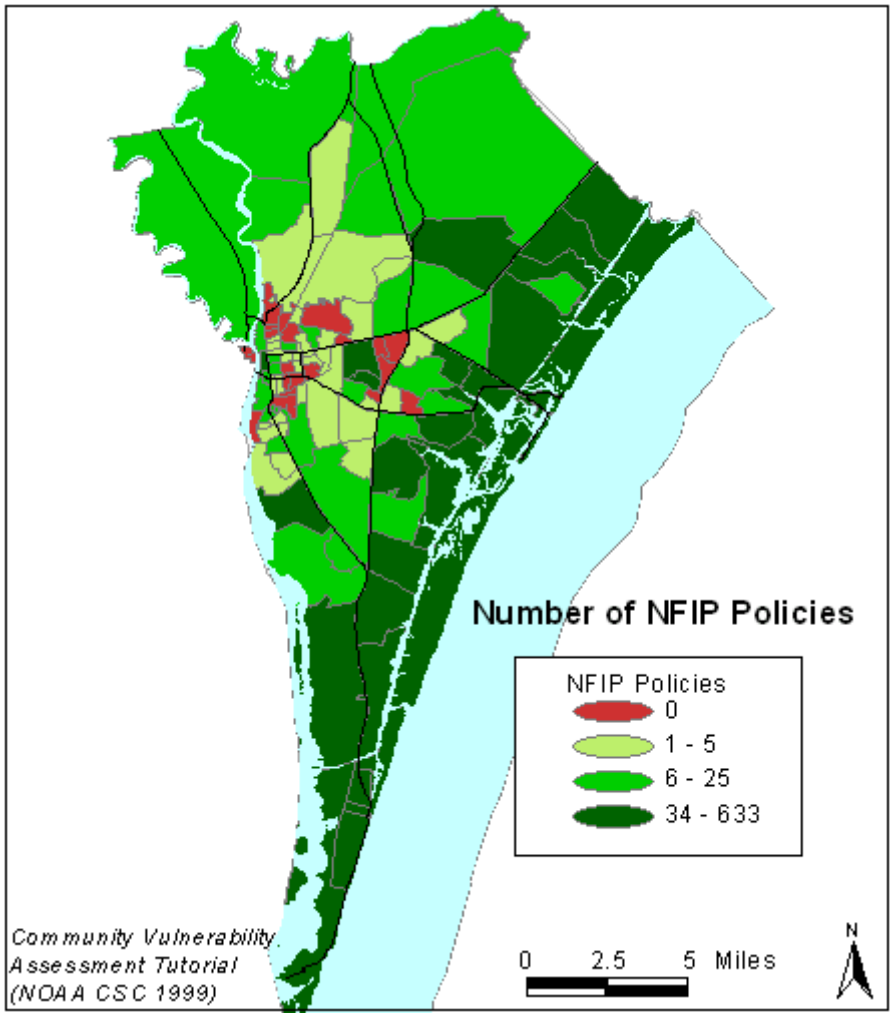
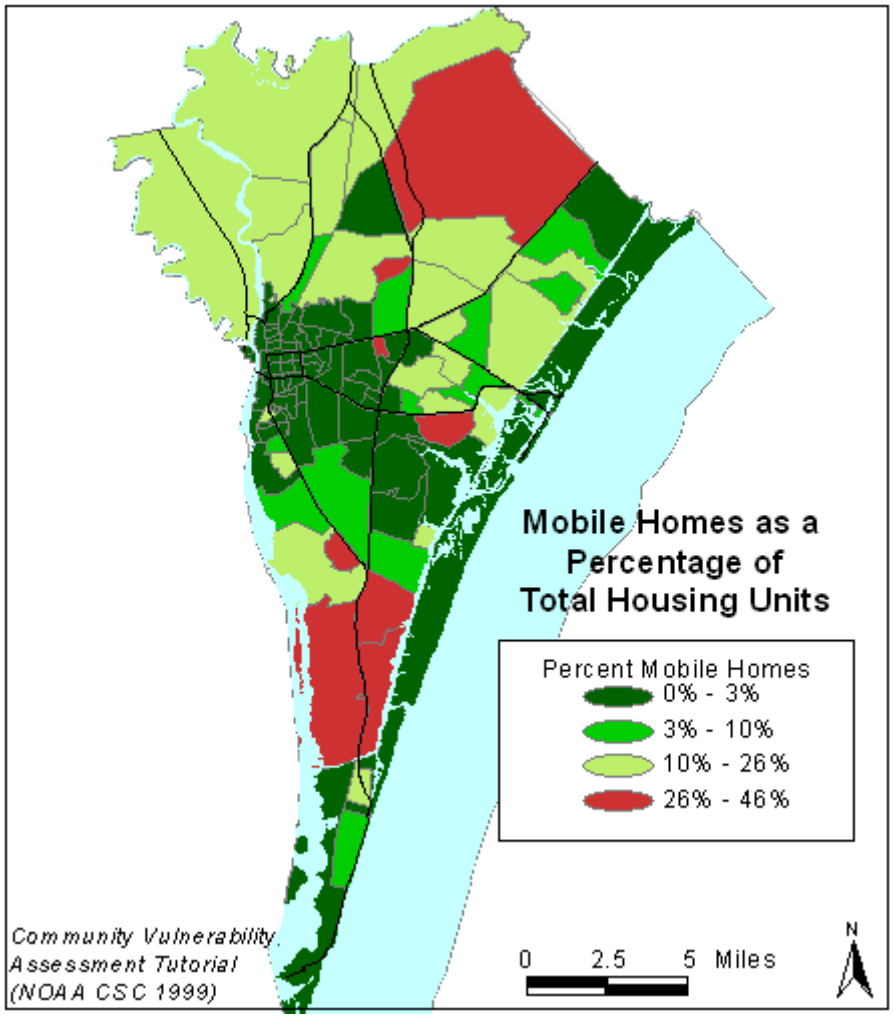
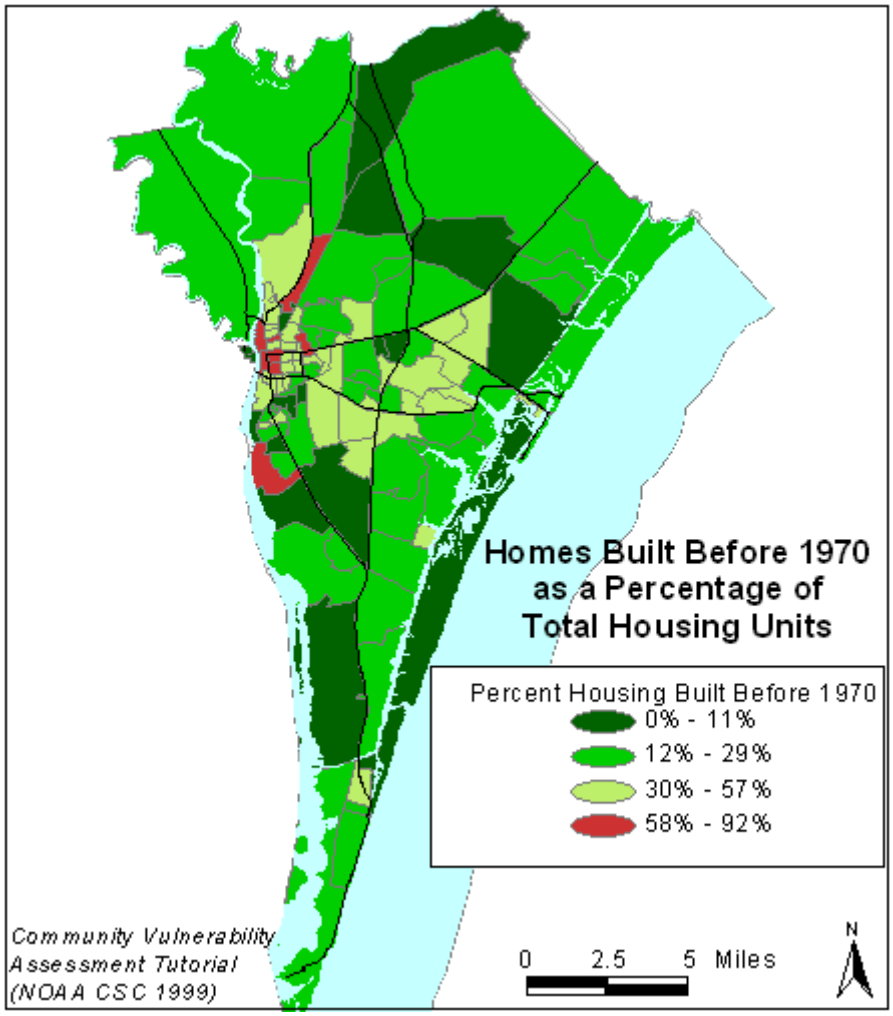
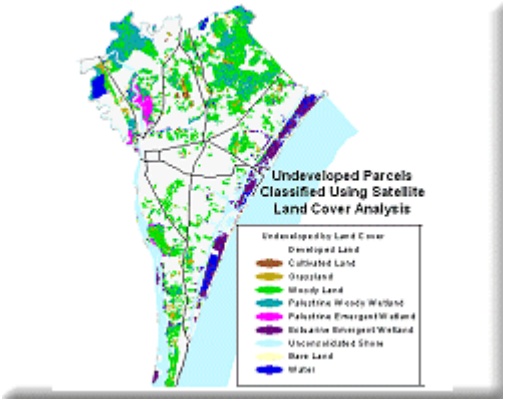


Figure 3.54


Mobile Homes as a
Percentage of
Total Housing Units
Percent Mobile Homes
0% - 3%
3% - 10%
10% - 26%
26% - 46%
Community Vulnerability
Assessment Tutorial
(NOAA CSC 1999)
0
2.5
5 Miles
N
Figure 3.55


Homes Built Before 1970
as a Percentage of
Total Housing Units
Percent Housing Built Before 1970
0% - 11%
12% - 29%
30% - 57%
58% - 92%
Community Vulnerability
Assessment Tutorial
(NOAA CSC 1999)
0
2.5
5 Miles
N
Figure 3.56

Results Summary



Introduction

This section contains a summary of the initial results and recommendations of New Hanover County's Vulnerability Assessment. These results target specific locations and priorities for identifying and completing mitigation actions.

Hazard Identification Summary

Recommendation 1.1

Future hazard mitigation projects should focus on minimizing damages from the following hazards (in priority order):

- Wind
- Flood
- Storm Surge
- Earthquake
- Wildfire
- Coastal Erosion
- Tornado

Mitigation projects should be multi-hazard and attempt to address as many of the above hazards as possible.

Hazard Analysis Summary

The map below is a general multi-hazard risk map for the hazards identified above.

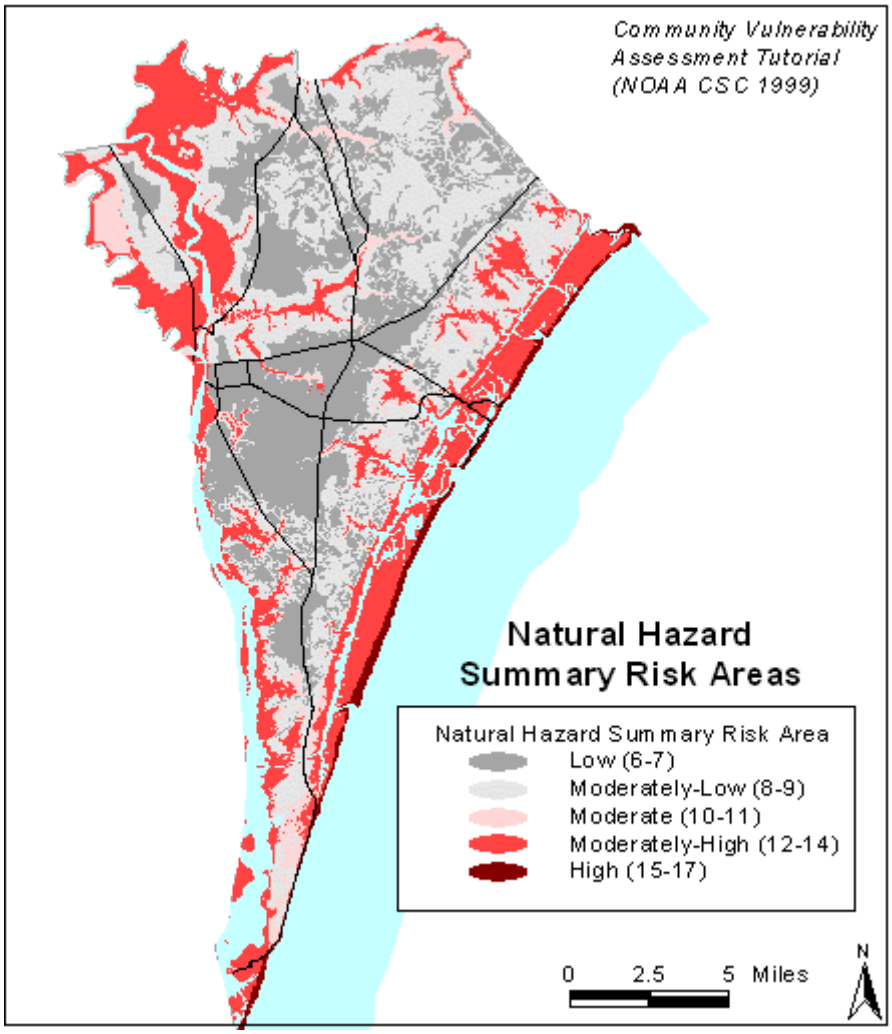


Figure 3.57

Recommendation 2.1

To the extent practicable, hazard mitigation projects should be prioritized according to applicability in high-risk and moderately high-risk areas.

Critical Facilities Summary

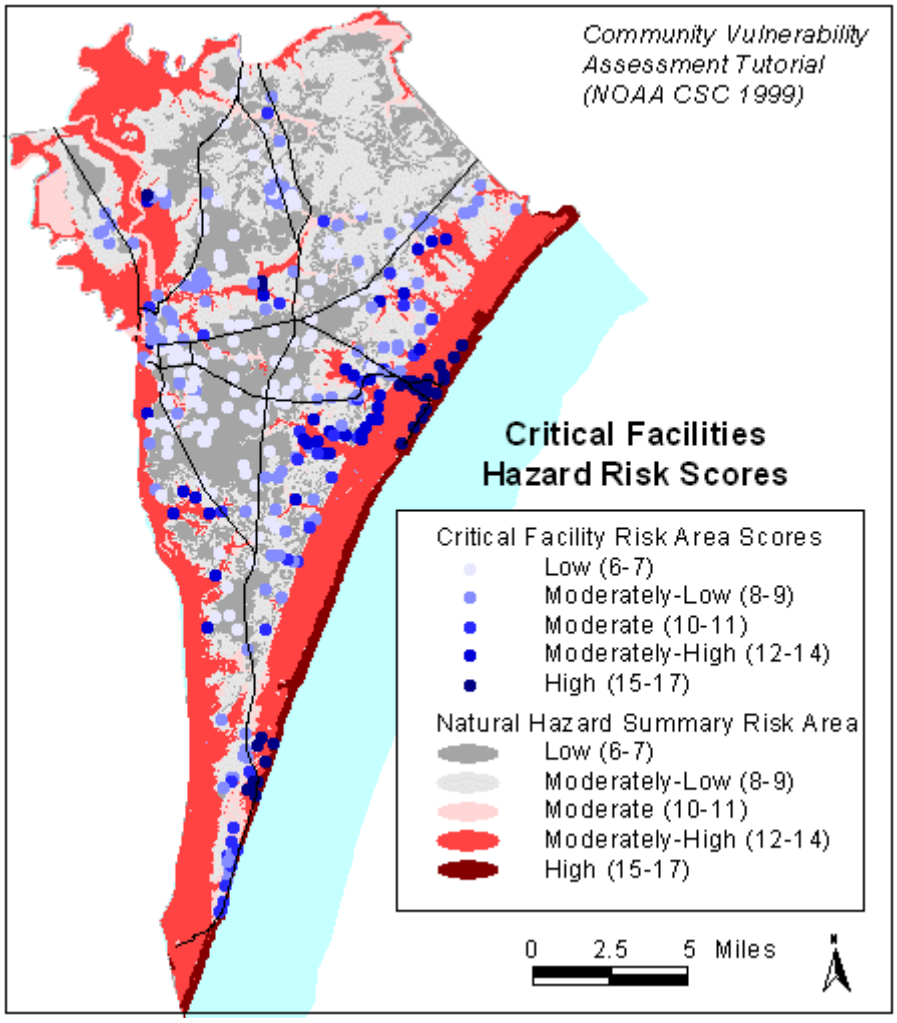


Figure 3.58

Recommendation 3.1

Prioritize mitigation projects on critical facilities and vulnerable population facilities in the following order:

1)Facilities with repetitive damage history.

2)Facilities with prior damage history.

3)Facilities with high or moderately high multi-hazard risk scores.

Recommendation 3.2 – Utilities, Communications, Transportation

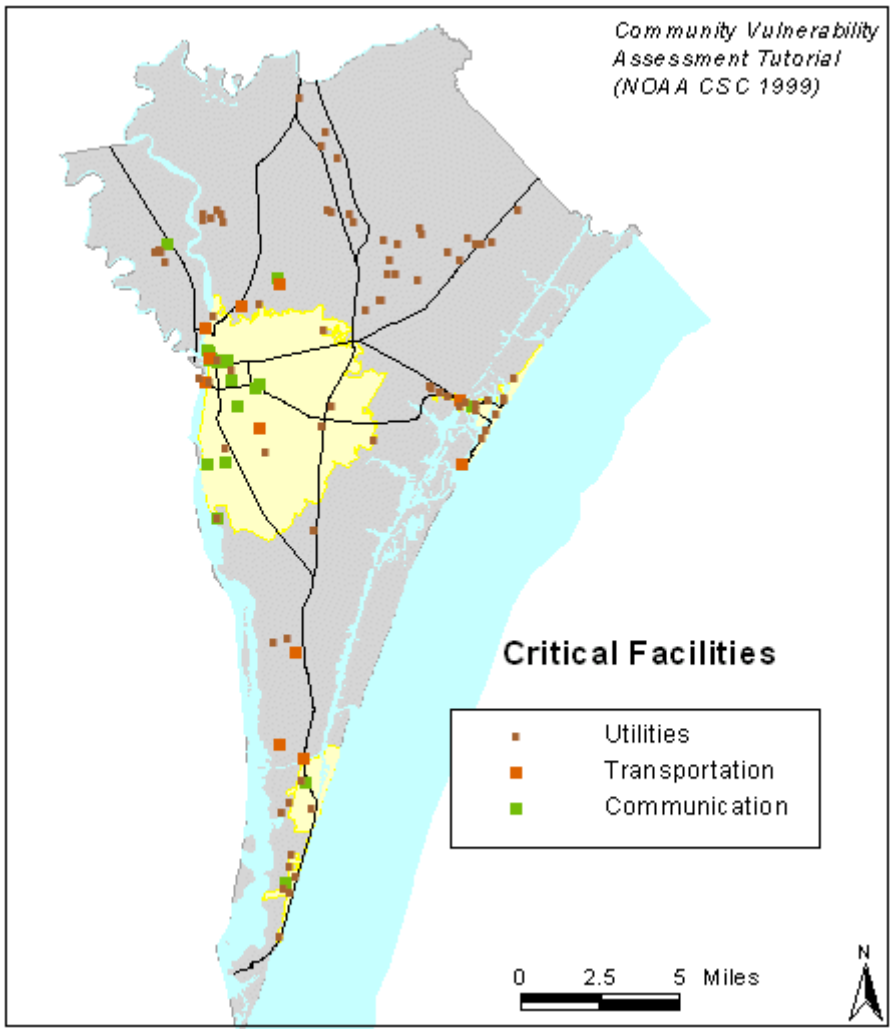


Figure 3.59

Conduct detailed structural and operational assessments on the following utilities, communication facilities, and transportation facilities to define necessary and appropriate mitigation actions:

1)All facilities essential to emergency operations.

2)Facilities with repetitive or prior damages.

3)Remaining facilities in high-risk locations.

4)Remaining facilities in moderately high-risk locations.

Recommendation 3.3 – Shelters

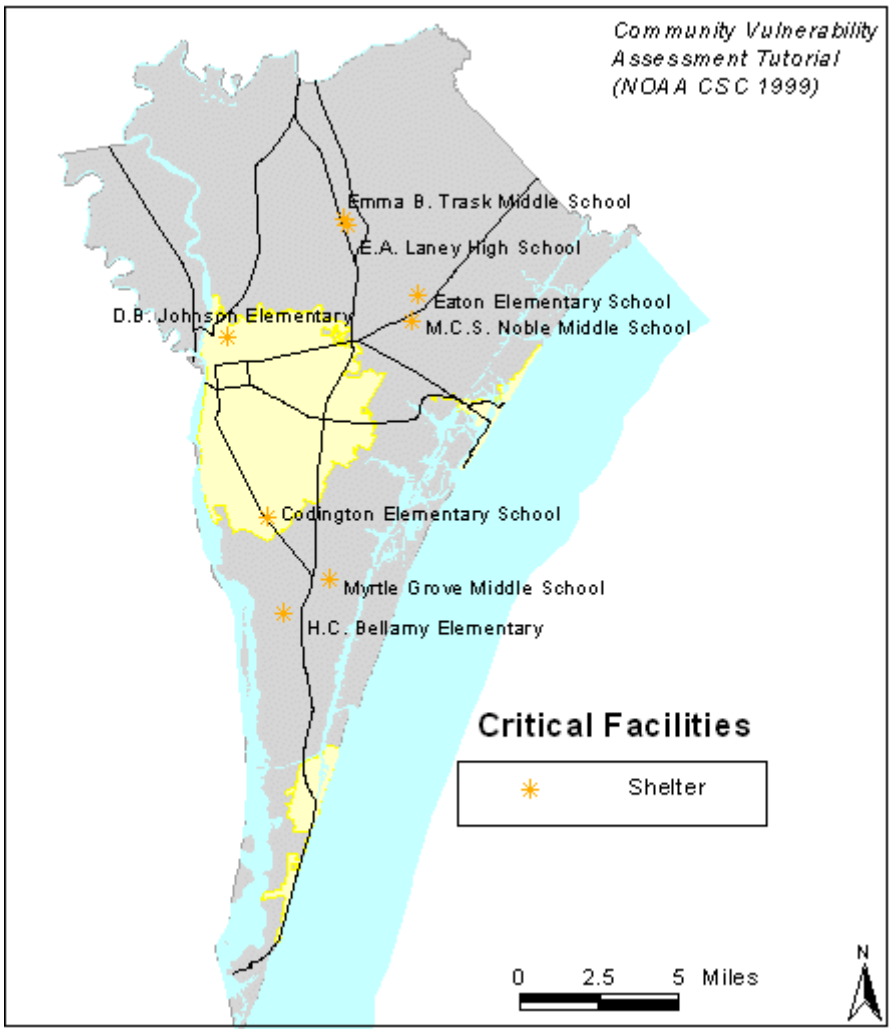


Figure 3.60

Conduct detailed structural assessments on all shelters and define necessary mitigation actions. Mitigation actions on all shelters are recommended as immediate priorities.

Recommendation 3.4 – Fire and Rescue, Police Facilities

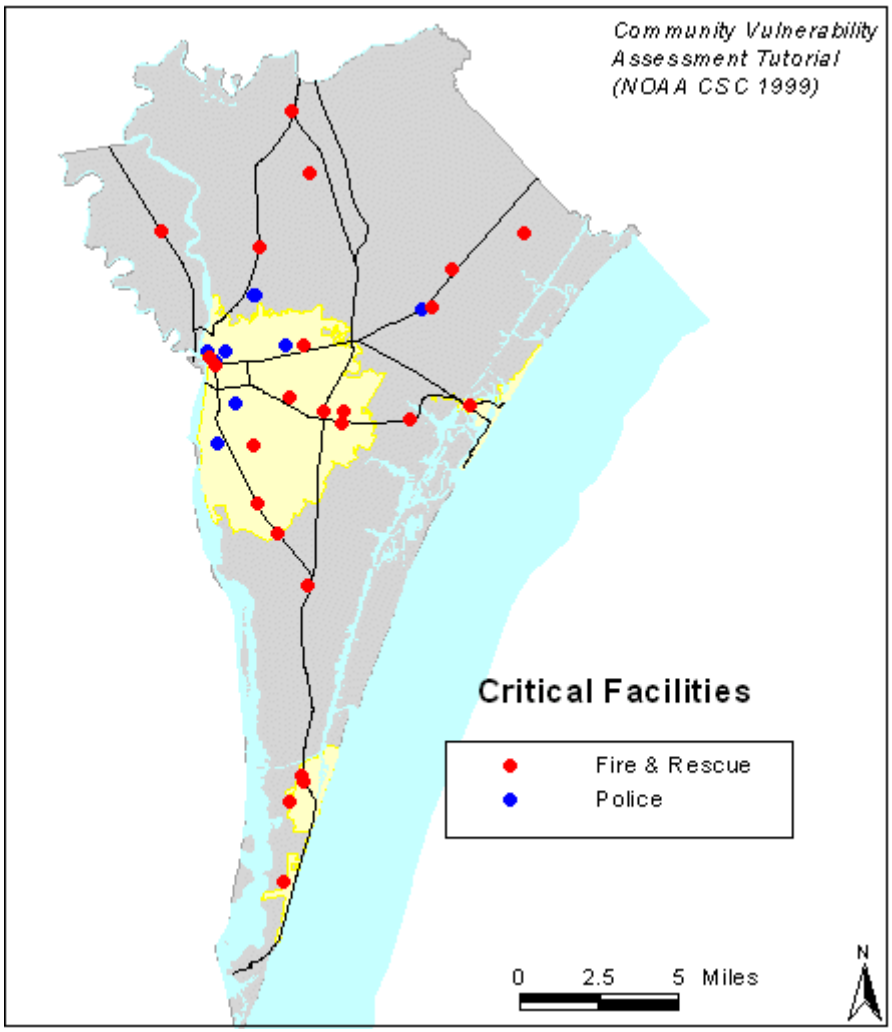


Figure 3.61

Conduct detailed structural and operational assessments on all facilities to define necessary mitigation actions in the following priority order:

1) Facilities with repetitive or prior damages.

2) Facilities in high-risk locations.

3) Facilities in moderately high-risk locations.

4) Remaining facilities.

Recommendation 3.5 – Government Facilities

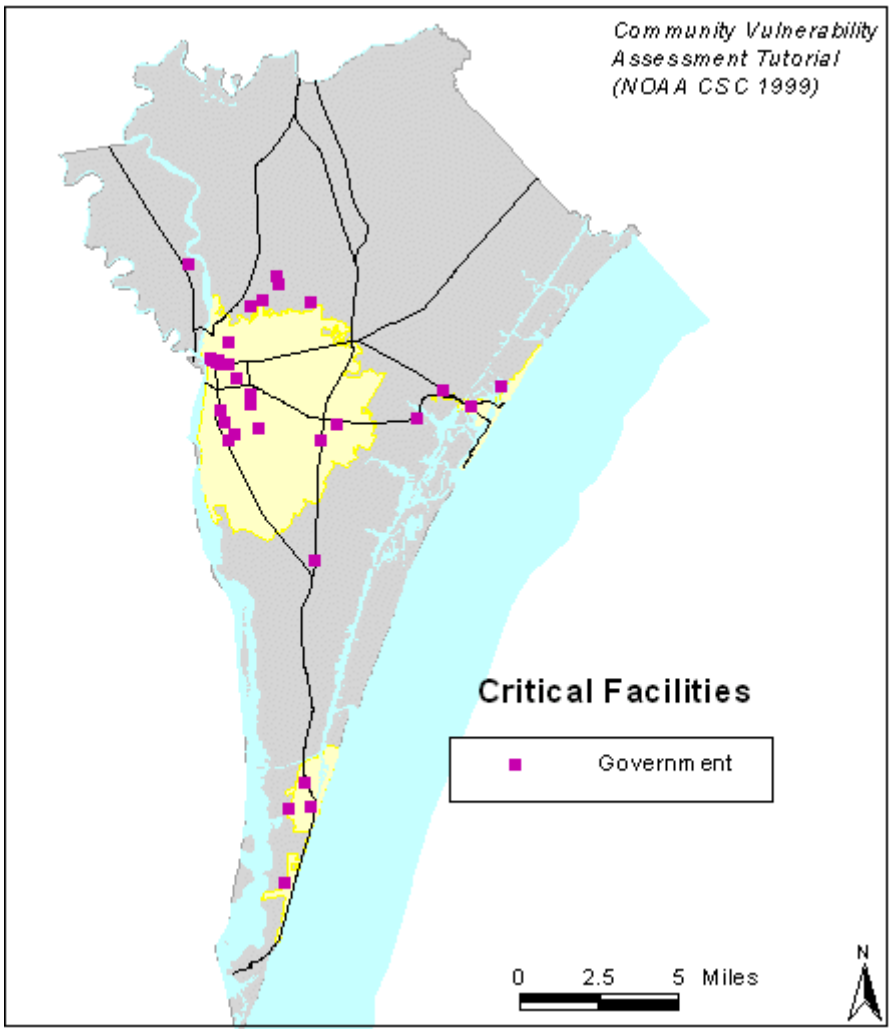


Figure 3.62

Conduct detailed structural and operational assessments on the following facilities:

1) Facilities with repetitive or prior damages.

2) Facilities in high-risk locations.

3) Facilities in moderately high-risk locations.

Recommendation 3.6 – Schools, Hospitals and Nursing Homes (Vulnerable Populations)

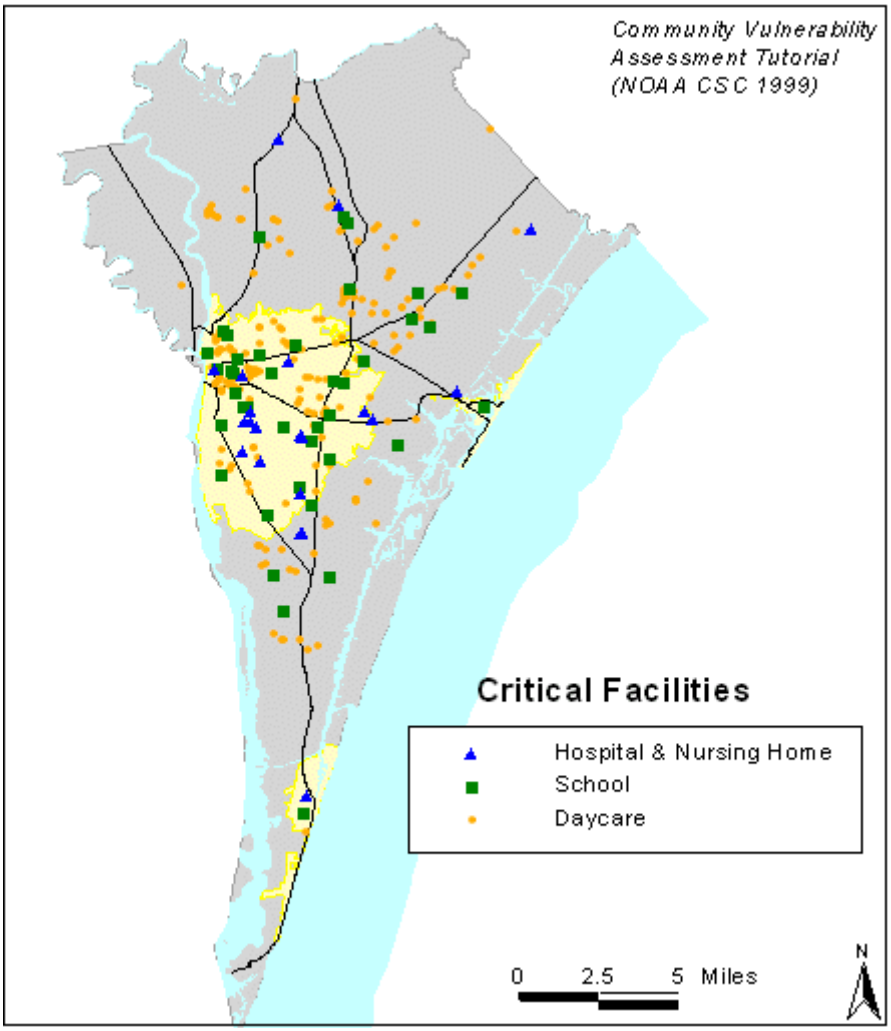


Figure 3.63

Conduct detailed structural assessments on all facilities in the following priority order:

1) Facilities with repetitive or prior damages.

2) Facilities in high-risk locations.

3) Facilities in moderately high-risk locations.

4) Remaining facilities.

Societal Analysis Summary

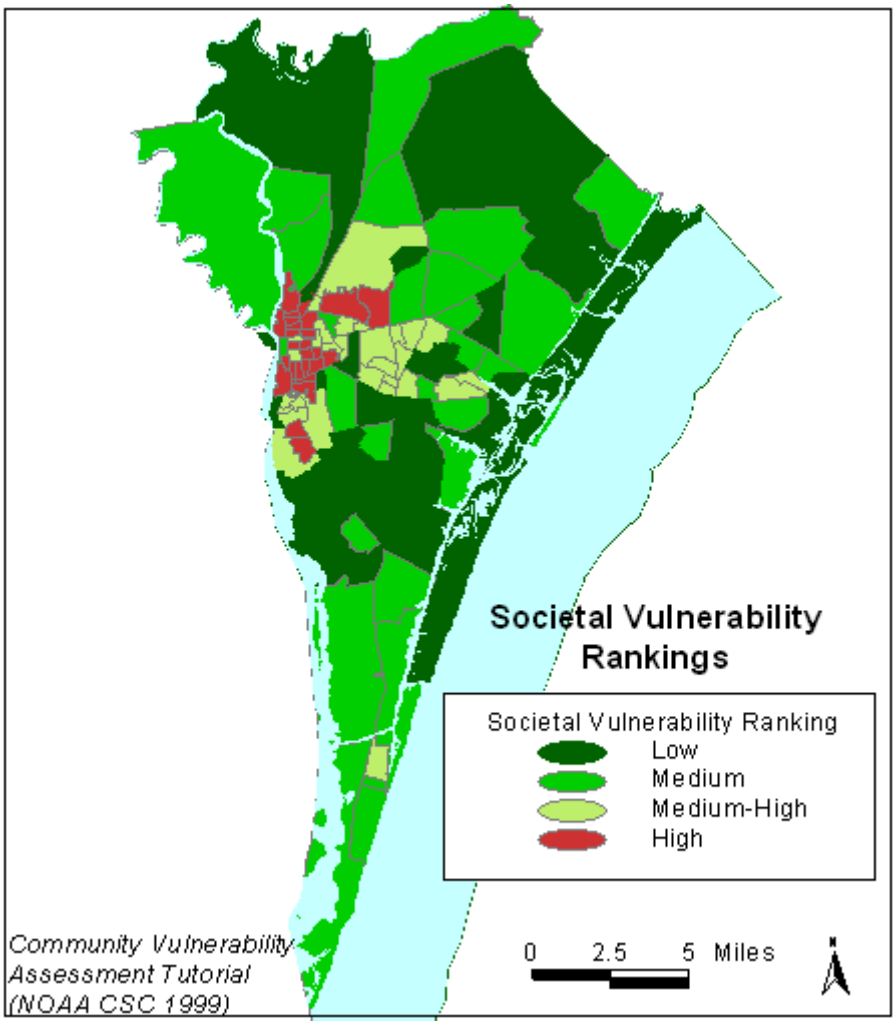


Figure 3.64

Recommendation 4.1

Target special hazard mitigation educational activities for neighborhoods in the special consideration areas. Pursue the delivery of information through local churches, schools, and community centers.

Recommendation 4.2

Develop hazard mitigation guidelines for use in Community Development Block Grant and other publicly funded projects in the special consideration areas.

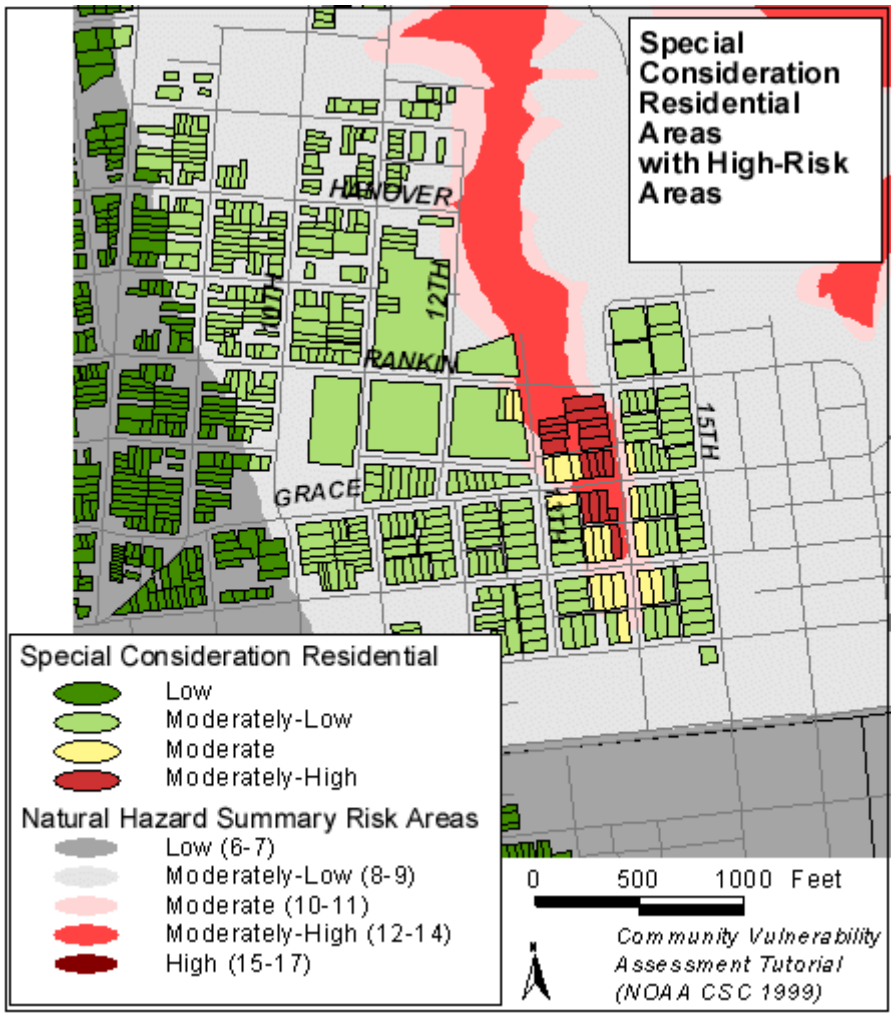
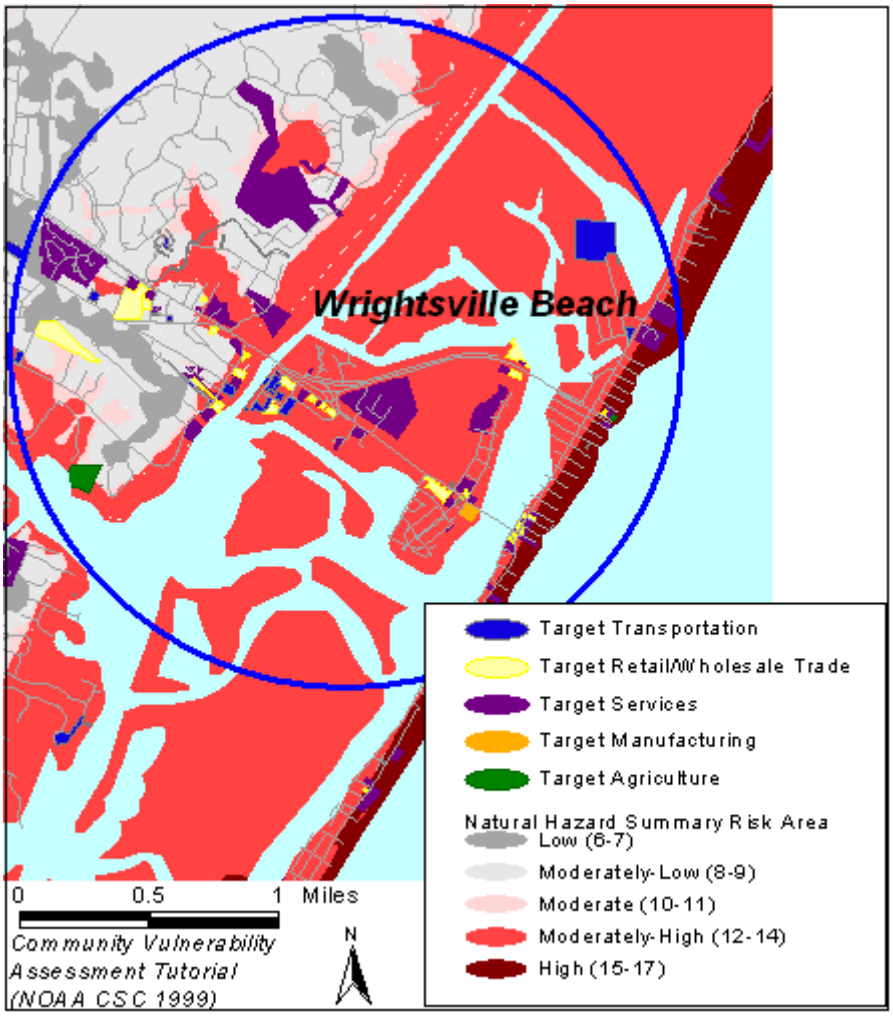


Figure 3.65

Recommendation 4.3

Identify and develop a low cost/high yield mitigation project to aid the residents of this high-risk area. Seek private sector partnerships (building supply companies, etc.) to help fund or provide supplies for the project. Possibly enlist support of local community volunteers or Americorps volunteers to complete the project.

Economic Analysis Summary


Wrightsville Beach
Target Transportation
Target Retail/Wholesale Trade
Target Services
Target Manufacturing
Target Agriculture
Natural Hazard Summary Risk Area
Low (6-7)
Moderately-Low (8-9)
Moderate (10-11)
Moderately-High (12-14)
High (15-17)
0
0.5
1 Miles
N
Community Vulnerability Assessment Tutorial (NOAA CSC 1999)
Figure 3.66

SIC	INDUSTRY	Employees	Annual Payroll	Establishments
----	TOTAL	67,260	1,516,529	5,433
15--	CONSTRUCTION	5,732	124,977	805
1500	General contractors and operative builders	1,928	45,387	282
1700	Special trade contractors	3,326	68,882	486
20--	MANUFACTURING	8,561	329,309	196
2800	Chemicals and allied products	2,322	111,248	11
3200	Stone, clay, and glass products	1,631	73,937	12
40--	TRANSPORTATION AND PUBLIC UTILITIES	4,036	108,954	253
4200	Trucking and warehousing	1,194	31,192	98
50--	WHOLESALE TRADE	3,805	103,945	387
5000	Wholesale trade - durable goods	2,260	63,565	263
5100	Wholesale trade - nondurable goods	1,459	38,559	119
52--	RETAIL TRADE	18,484	251,398	1,337
5300	General merchandise stores	2,013	25,840	31
5310	Department stores	1,667	20,802	11
5400	Food stores	2,299	26,395	112
5410	Grocery stores	2,080	23,948	75
5500	Automotive dealers and service stations	1,974	54,076	167
5800	Eating and drinking places	7,279	61,106	369
60--	FINANCE, INSURANCE, AND REAL ESTATE	3,647	87,296	474
6000	Depository institutions	1,056	23,841	74
6500	Real estate	1,365	24,314	203
70--	SERVICES	22,426	500,528	1,855
7200	Personal services	1,062	13,896	136
7300	Business services	4,392	79,392	306
7360	Personnel supply services	2,255	41,125	39
8000	Health services	8,280	237,851	330
8600	Membership organizations	1,356	15,443	163
8700	Engineering and management services	1,899	72,302	222

Figure 3.67

Recommendation 5.1

Conduct a business disaster preparedness survey for all businesses in the industries identified in the table above. Target those business located in high-risk and moderately high-risk areas.

SIC	INDUSTRY	100-499 Employees	>500 Employees
----	TOTAL	79	6
15--	CONSTRUCTION	2	0
1510	General building contractors	1	0
1730	Electrical work	1	0
20--	MANUFACTURING	13	3
2323	Men's and boys' neckwear	1	0
2439	Structural wood members, n.e.c.	1	0
2449	Wood containers, n.e.c.	1	0
2657	Folding paperboard boxes	1	0
2710	Newspapers	1	0
2819	Industrial inorganic chemicals, n.e.c.	1	1
2834	Pharmaceutical preparations	1	0
2865	Cyclic crudes and intermediates	1	0
2869	Industrial organic chemicals, n.e.c.	1	0
3230	Products of purchased glass	0	1
3531	Construction machinery	1	0
3535	Conveyors and conveying equipment	1	0
3714	Motor vehicle parts and accessories	1	0
3724	Aircraft engines and engine parts	0	1
399\	Administrative and auxiliary	1	0
40--	TRANSPORTATION AND PUBLIC UTILITIES	3	1
4210	Trucking and courier services, except air	1	0
4491	Marine cargo handling	1	1
4910	Electric services	1	0
50--	\WHOLESALE TRADE	1	0
5136	Men's and boys' clothing	1	0
52--	RETAIL TRADE	25	0
5210	Lumber and other building materials	1	0
5310	Department stores	7	0
5390	Misc. general merchandise stores	1	0
5410	Grocery stores	5	0
5510	New and used car dealers	1	0
5812	Eating places	9	0
599\	Administrative and auxiliary	1	0
60--	FINANCE, INSURANCE, AND REAL ESTATE	4	0
6030	Savings institutions	1	0
6510	Real estate operators and lessors	1	0
6552	Subdividers and developers, n.e.c.	1	0
679\	Administrative and auxiliary	1	0
70--	SERVICES	31	2
7010	Hotels and motels	2	0
7213	Linen supply	1	0
7218	Industrial launderers	1	0
7291	Tax return preparation services	1	0
7349	Building maintenance services, n.e.c.	1	0
7363	Help supply services	6	0
7381	Detective and armored car services	1	0
8010	Offices and clinics of medical doctors	3	0
8049	Offices of health practitioners, n.e.c.	1	0
8050	Nursing and personal care facilities	5	0
8060	Hospitals	0	2
8080	Home health care services	5	0
8210	Elementary and secondary schools	1	0
8640	Civic and social associations	1	0
8711	Engineering services	1	0
8731	Commercial physical research	1	0

Figure 3.68

Recommendation 5.2

Identify as many of the businesses listed in the table above as possible. Develop a special business education program for major employers and enlist these businesses as hazard mitigation partners. Prioritize those businesses employing more than 500 people.

Environmental Analysis Summary

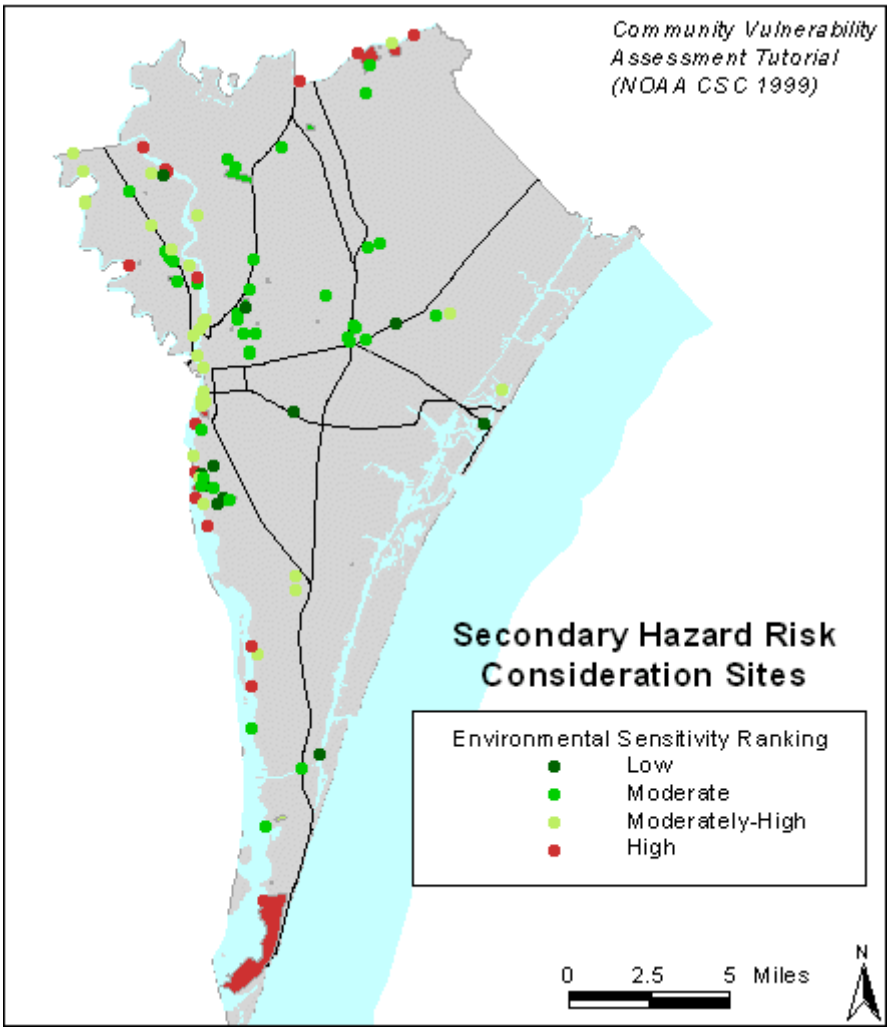


Figure 3.69

Recommendation 6.1

Develop and conduct a disaster preparedness survey designed to address secondary environmental hazards. Prioritize businesses in high-risk and moderately high-risk locations, as well as those with high environmental sensitivity scores.

Recommendation 6.2

Conduct detailed structural assessment on all public-sector secondary risk sites to define necessary mitigation actions. Assessments should be prioritized according to multi-hazard risk summary scores.

Mitigation Opportunities Summary

Recommendation 7.1

Evaluate existing development regulations to ensure that hazards are considered during zoning and subdivision application processes.

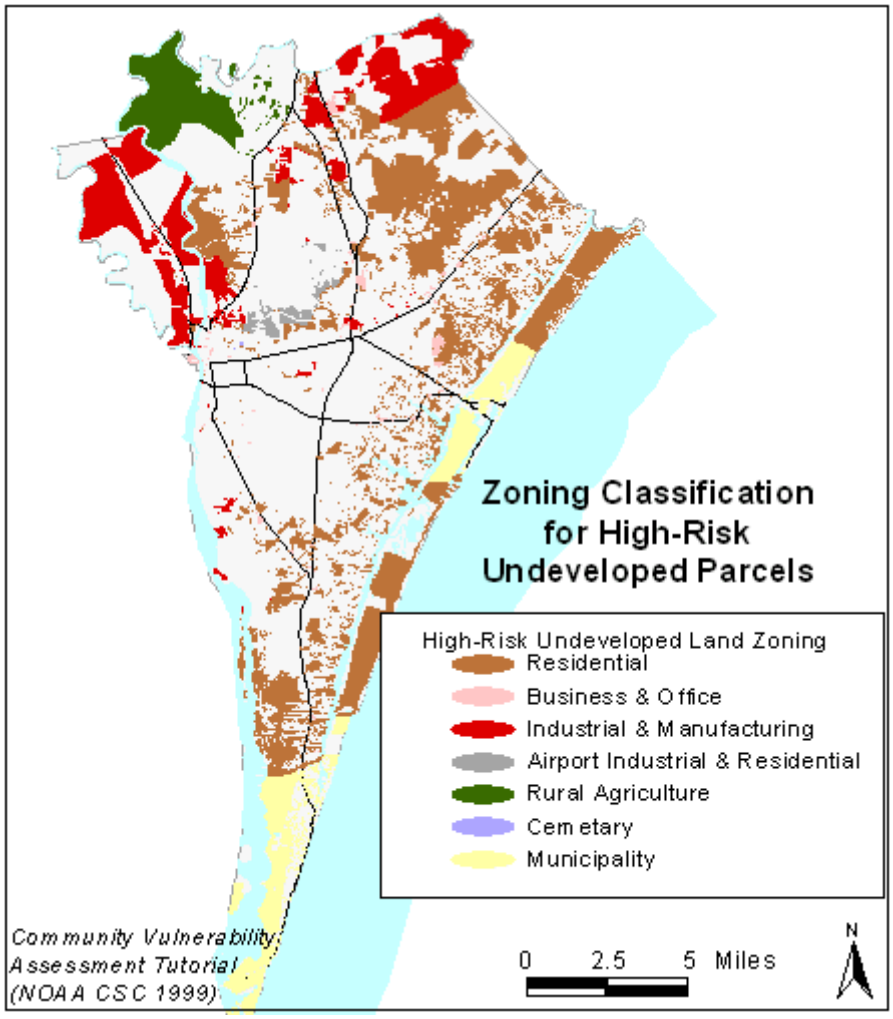


Figure 3.70

Recommendation 7.2

Identify hazards considerations for incorporation into comprehensive plans.

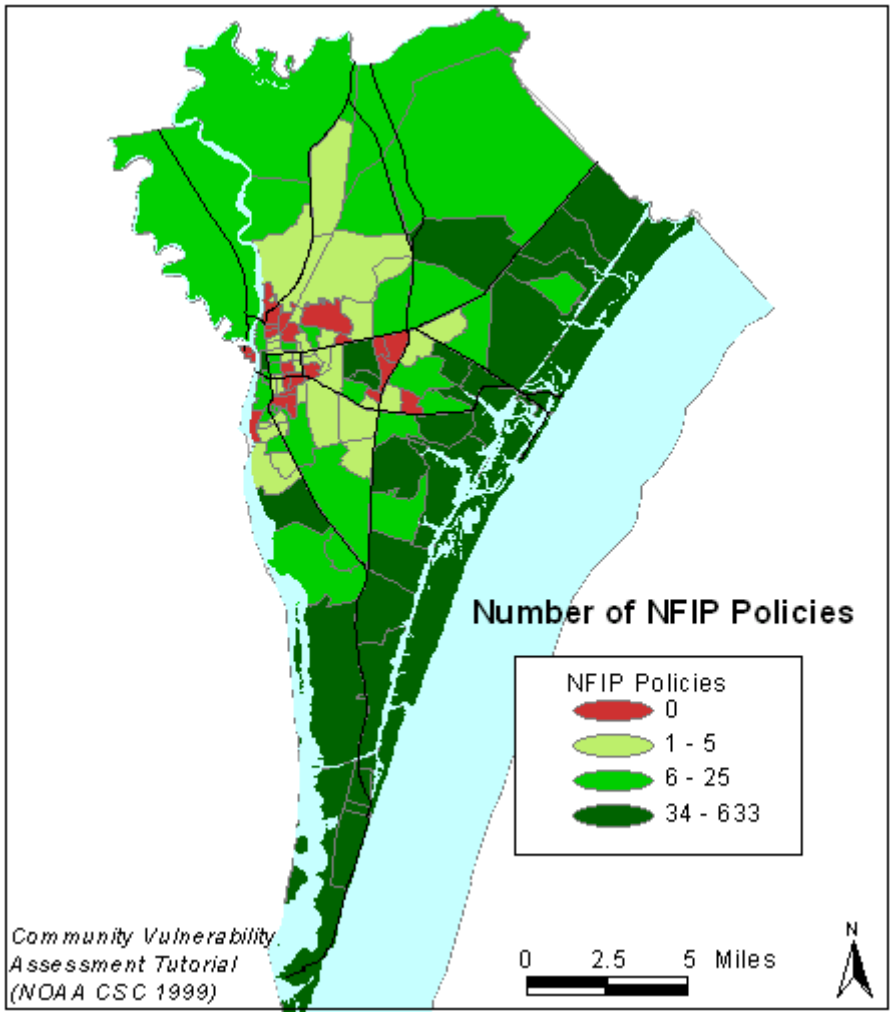


Figure 3.71

Recommendation 7.3

Target flood insurance education program for homeowners in block groups with >58 percent homes built before 1970.

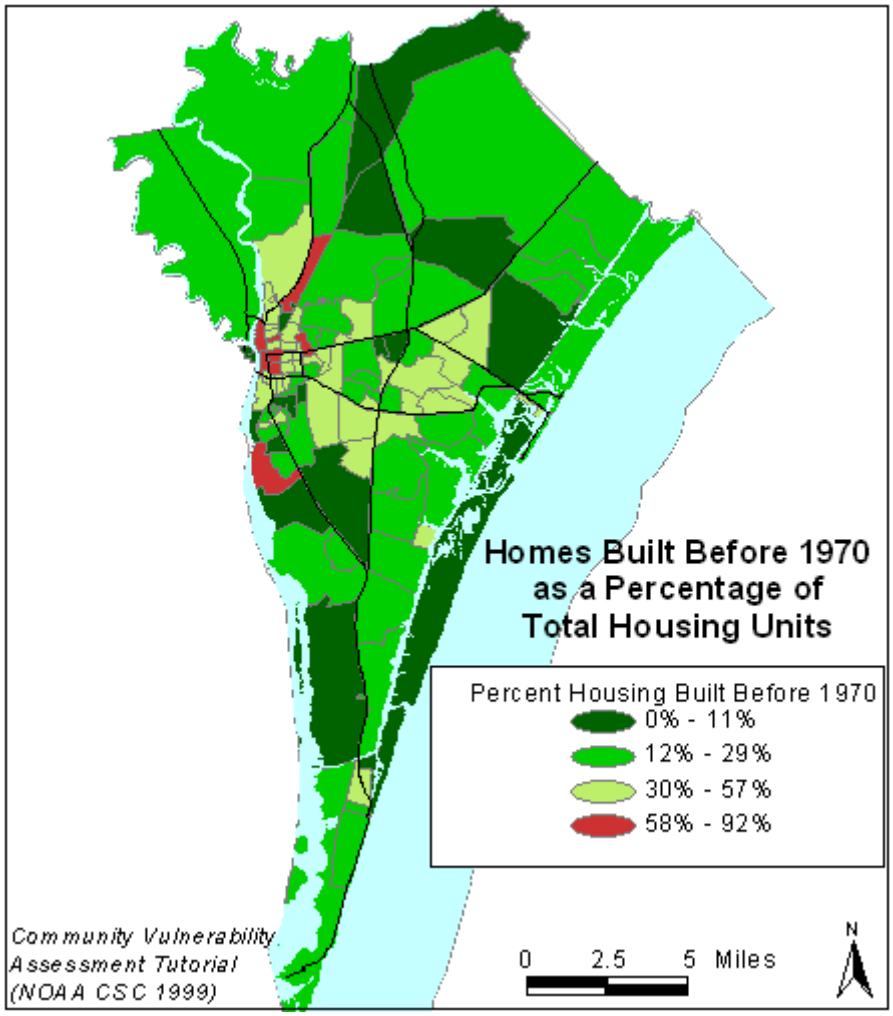
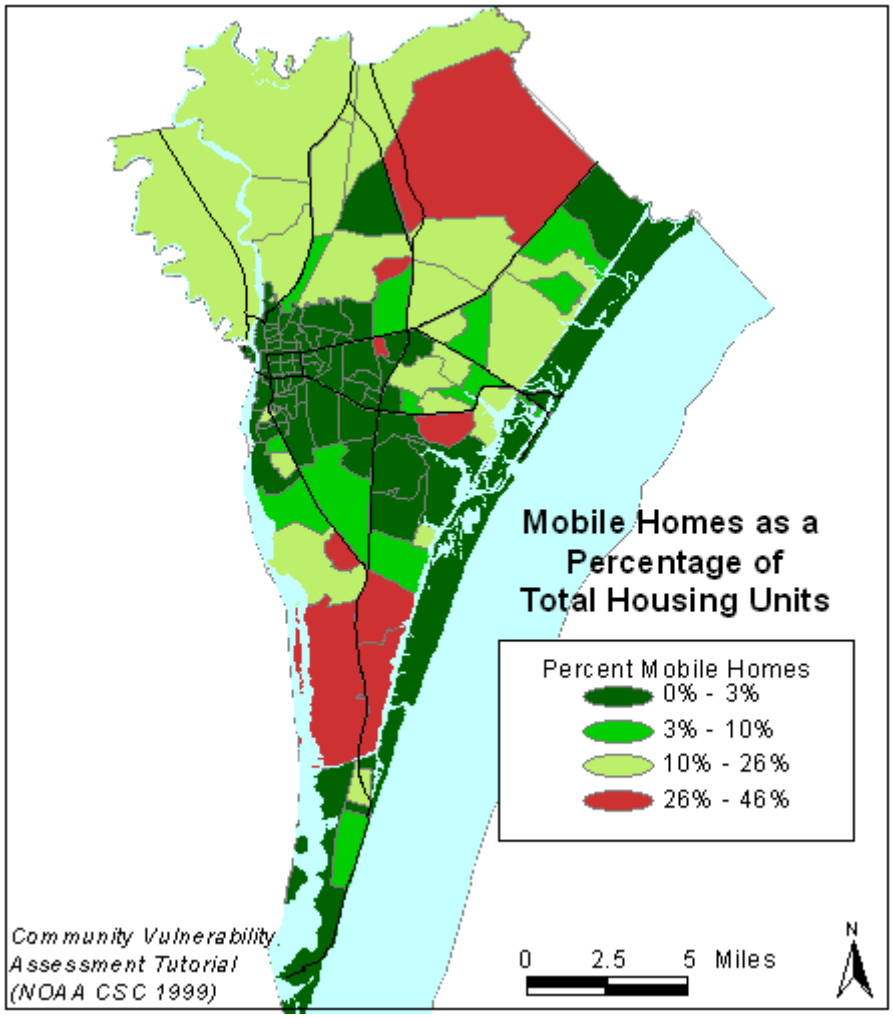


Figure 3.72

Recommendation 7.4

Target mobile home hazard mitigation education program in block groups with >30 percent mobile homes.


Mobile Homes as a
Percentage of
Total Housing Units
Percent Mobile Homes
0% - 3%
3% - 10%
10% - 26%
26% - 46%
Community Vulnerability
Assessment Tutorial
(NOAA CSC 1999)
0
2.5
5 Miles
N
Figure 3.73